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ABSTRACT

This volume, the first in a two-volume core curriculum, is designed for use in teaching a course in basic bricklaying. Included in the introductory section of the guide are units on the free enterprise system, the economics of free enterprise, industry orientation, ways of becoming a good leader, job advancement, and safety and first aid. The next group of units deals with basic math, measurement, basic plan reading, and estimation. Concluding the curriculum are units on arc welding and oxyacetylene cutting. Each instructional unit contains some or all of the following: performance objectives, suggested activities, information sheets, transparency masters, assignment sheets, job sheets, tests, and answers to the test and assignment sheets. (MN)

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bricklaying curriculum: basic core

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Bricklaying Curriculum

Basic Core

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BRICKLAYING CURRICULUM
BASIC CORE

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FOREWORD

In 1975 the Associated General Contractors of America met with representatives of the Oklahoma Curriculum and Instructional Materials Center to discuss the possibility of developing, as a cooperative project, a course of instruction designed for training bricklayers who will make their careers in industrial and commercial construction.

This publication is the result of that discussion. It is the product of close coordination between general contractors, bricklayers, and vocational/technical educators. This manual represents a conscious effort to meld the practical experience of those in the construction industry with the expertise of those in the field of vocational education.

The trainers of skilled construction workers are faced with the challenge of providing thorough and modern training to the backbone of the construction industry, its work force. The purpose of this manual is to assist bricklayer instructors in providing a high-caliber instructional program. In 1982 AGC and CIMC decided that there was a need to update this manual in order to keep up with the everchanging materials, skills, techniques, and demands of the profession. Therefore, we have revised this manual with these changes in mind. Although the format reflects a systematic approach to instructional materials development and the latest in educational technology innovations, the information in *Bricklaying Curriculum: Basic Core* should be adapted and modified to coincide with local conditions. To make the training process complete, the materials should be coupled with the instructor's own methods and experience, and with additional materials.

Dr. Francis T. Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

Robert B. Fay, Chairman
Manpower and Training Committee
Associated General Contractors of America

PREFACE

For many years contractors and those responsible for training bricklayers felt the need for instructional materials to be used in the training. In 1977 the Associated General Contractors of America, with the cooperation and support of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, accepted the challenge to produce a manual for use in training bricklayers in those areas in which they are expected to be proficient.

Instructional material in this manual is written in terms of student performance, using measurable behavioral objectives. This is an innovative approach to teaching that accents and augments the teaching/learning process. Criterion-referenced evaluation instruments provide for a uniform measurement of student progress.

Bricklayer instructors are faced with the challenge of providing students with the skill and related information necessary to meet the demands of a changing profession. Competition for jobs is greater than ever. Therefore, the bricklayer must be better trained and better equipped to find and retain meaningful employment. This is why AGC and CIMC felt a need to revise and update this manual.

The purpose of this manual is to assist bricklayer instructors in providing instruction throughout the industry. This publication should be supplemented by each instructor's methods and materials. Any information in this manual that does not concur with the instructor's course of study can be modified to meet personal needs.

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We are grateful to the following individuals and companies for their technical support during the development of this manual.

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Laborn J. "Bud" Hendrix, AGC-CIMC Writer
Curriculum and Instructional Materials Center

USE OF THIS PUBLICATION

Instructional Units

Bricklaying Curriculum: Basic Core contains three sections and twelve instructional units. A standard format was established in 1970 for development of instructional materials for all Oklahoma vocational teachers. This format includes eight basic components that form a unit of instruction: performance objectives, suggested activities for the teacher, information sheets, assignment sheets, job sheets, transparency masters, tests, and answers to tests and assignment sheets. Depending on the specific objectives, there may or may not be transparency masters, assignment sheets, and job sheets included in the unit of instruction.

All of the unit components "zero in" on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help him or her determine the following

A. Amount of material that can be covered in each class period
B. Skills that must be demonstrated
    1. Supplies and equipment needed
    2. Amount of practice needed
    3. Amount of class time needed for demonstrations
C. Supplementary materials, such as pamphlets and filmstrips, that must be ordered
D. Resource people who must be contacted

Performance Objectives (white pages)

Each unit of instruction is based on the performance needed for successful employment in an occupational area. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction, and specific objectives, stating the performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching/learning process, it is important that teachers and students have a common understanding of the intent of the objectives. Following is a list of performance terms, their meanings, and behavioral synonyms that may have been used in this material.

A. Name — The individual supplies a name for objects, events, or people

Behavioral synonyms: Label, list, letter, record, reiterate, repeat, write

B. Identify — The individual selects a named, described, or pictured object by pointing to it, touching it, picking it up, or selecting it

Behavioral synonyms: Select, mark, match, choose, judge

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C. State a rule — The individual communicates a relationship or principle that could be used to solve problems or perform a task

D. Apply a rule — The individual supplies an answer to a problem by using a stated relationship or principle

Behavioral synonyms: Solve, calculate

E. Describe — The individual relates sufficient characteristics or properties of an object or event so that a second individual will be able to state what is being discussed

Behavioral synonyms: Define, discuss, interpret, recite, tell how, tell what happens when

F. Distinguish — The individual selects an object or event from two or more that are easily confused

Behavioral synonyms: Discriminate, differentiate

G. Order — The individual arranges three or more objects or events in a sequence based on a stated property

Behavioral synonyms: Arrange, sequence, list in order, classify, divide, isolate, sort

H. Construct — The individual makes a physical object, a verbal statement, or a drawing

(NOTE: *Construct* is used when the finished product or result is important.)

Behavioral synonyms: Draw, make, build, design, formulate, reproduce, transcribe, convert, put together, compile

I. Demonstrate — The individual performs several operations necessary to carry out a specified process

(NOTE: *Demonstrate* is used when it is desirable to watch the student perform a task, one of the highest levels of student performance.)

Behavioral synonyms: Show your work, show procedure, perform an experiment, perform the steps, operate, remove, replace, turn off/on, (dis)assemble, (dis)connect

The objectives should be provided for students and stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Prepare for each unit by deciding how each objective can best be taught.

The objective sheet may also be used as a quick pretest to determine prior knowledge of students and to determine whether further study or activities are necessary. Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When changes in objectives are made, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion test items.

Suggested Activities (pink pages)

This component is included only in teacher material. The suggested activities page assists teachers during the preparation stage of the teaching/learning process by providing suggestions for delivery and/or presentation during the instructional process. Read the suggested activities before teaching the units so that supplemental materials can be obtained, audiovisual materials prepared, and outside resources contacted. Duties of the teacher will vary according to the particular unit.

The references that are listed are ones used in the development of each unit. They should be used by the teacher to supplement her or his knowledge of the subject area or to help students with particular interests or occupational objectives in the area covered.

Information Sheet (green pages)

The information sheet provides "must know" content essential for meeting the cognitive (knowledge level) objectives of the unit. The information is written in a topical outline form and is keyed to the specific objectives.

Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. The information sheet may also be used for coordination activities and advisory committees.

Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide motivation for each unit.

Transparency Masters (white pages in teacher material and green in student material)

Transparency masters provide information in a special way. Transparencies direct the class' attention to the topic of discussion. Transparencies may present new information, or they may reinforce information presented in the information sheet. They are particularly effective when identification is necessary. Make transparencies and place them in the notebook where they will be immediately available for use.

Assignment Sheets (brown pages)

Assignment sheets give students a chance at problem solving, self-assessment, and/or practical experience with the information. They assist students in the application of knowledges that are necessary prerequisites to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided when appropriate and can be used by the student and/or teacher for checking student progress.

Job Sheets (blue pages)

Job sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomoter skill. They describe a step-by-step procedure needed to complete each task or job. Diagrams, photographs, and illustrations are provided to assist students in achieving the skill.

Instruments in job sheets are not in order of use. This should be taught in the classroom. In this way, students will not depend entirely on job sheets for instrument setup.

A teacher should demonstrate to students the procedures outlined in each job sheet. Furthermore, the teacher needs to localize the job sheet according to the equipment and supplies available in the local lab or shop situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this vocational instruction.

Tests (yellow pages)

This component provides criterion-referenced evaluation of every objective listed in the unit of instruction. It is crucial to note that both paper/pencil and performance objectives must be evaluated.

The tests may be written or oral. It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of questions from the units covered may be used for final tests at the end of each term if desired. If objectives have been added, deleted, or modified, be sure to make the changes on the test.

The acceptable response on a unit test, 85 percent in most units, may be raised or lowered to fit the topic or students' ability levels. The percentage applies to the overall score, not to each individual question. The final unit grade should be obtained by using the paper/pencil score along with evaluations of student demonstrations of the desired skills.

Answers to Test and Assignment Sheets (pink pages)

These components are designed to assist the teacher in evaluation of student performances.

Page Numbering

Each publication from the Curriculum and Instructional Materials Center is assigned a specific abbreviation. For example, *Bricklaying Curriculum: Basic Core* has been abbreviated BLC. The units are then numbered consecutively within each section. An example of a page number is BLC-1-A. Since CIMC publications are loose leaf, this system of page numbering was adopted so that pages from different manuals would not get mixed up.

Methods of Disseminating Material

Material may be given out a unit or page at a time to keep the material before the student always new. Some teachers ask students to furnish a three-ring binder for the units. This is convenient for taking the materials home to study. Upon completion, each unit is then placed in a larger binder. The large binders may be purchased at cost from the CIMC. Some teachers store the materials by units in filing cabinets or boxes until needed. All the units may be given out at once if desired.

For best results, provide student materials for each student. Student materials contain everything but the test answers, answers to assignment sheets, and suggested activities. All tests are collated at the back of student material and should be removed and stored until needed. Students should be allowed to take their materials home at the end of the year.

Teaching Methods

It is a challenge to keep students motivated. Supplement the objectives by providing the "why," personal experiences, and current information. Prepare for each unit by deciding how each objective can best be taught. Allow students to become involved in preparing and planning.

Competency Profiles

Competency profiles are folders used to document student performance. The profile contains a list of the specific job competencies that should be achieved prior to leaving the training program.

FREE ENTERPRISE SYSTEM
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to explain how the free enterprise system works, interpret a flow chart for the production of goods and services in the free market system, and draw a conclusion about the characteristics most important to being a successful entrepreneur. The student will show this knowledge by completing the assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with the free enterprise system to their correct definitions.
2. Select from a list the essential components of the free enterprise system.
3. Discuss ways the free enterprise system affects consumers.
4. Discuss ways the free enterprise system affects business and industry.
5. Label a flow chart showing production of goods and services in the free market system.
6. Select from a list characteristics of successful entrepreneurs.
7. Analyze components of the free enterprise system.
8. Interpret a flow chart for production of goods and services.
9. Survey local equipment dealers.
10. Draw a conclusion about the characteristics most important to being a successful entrepreneur.

FREE ENTERPRISE SYSTEM
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order "Checklist for Going Into Business."

(NOTE: The booklet may be obtained free of charge by contacting the Small Business Administration, 200 N.W. 5th Street, Oklahoma City, Oklahoma 73102.)

B. Obtain transparency.

(NOTE: Transparency is available from AGC and CIMC.)

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

G. Arrange for a number of entrepreneurs to speak to the students. The speakers should talk about subjects such as

1. How they became interested in owning their own business
2. How they selected their particular type of business
3. Supply of and demand for their goods or services
4. Outlook for the future of their business

(NOTE: Provide time for a question and answer session.)

H. Arrange to have a representative of the Small Business Administration speak to the students. The speaker should talk about the questions people should ask themselves before starting a business.

(NOTE: Provide time for a question and answer period.)

I. Give test.

J. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

SUGGESTED ACTIVITIES

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Transparency master: TM#1 — The Free Market System

   E. Assignment sheets

      1. Assignment Sheet #1 — Complete Free Enterprise System Crossword Puzzle

      2. Assignment Sheet #2 — Analyze Components of the Free Enterprise System

      3. Assignment Sheet #3 — Interpret a Flow Chart for Production of Goods and Services

      4. Assignment Sheet #4 — Survey Local Equipment Dealers

      5. Assignment Sheet #5 — Draw a Conclusion About the Characteristics Most Important to Being a Successful Entrepreneur

   F. Answers to assignment sheets

   G. Test

   H. Answers to test

III. Unit references

   A. Amos, Joe. *Distributive Education I: Course of Study.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1973.

   B. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Materials, Volume I, Basic Core.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1981.

   C. Nelson, Frank W. *Group Instruction for Cooperative Programs.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1978.

SUGGESTED ACTIVITIES

D. Nelson, Robert E., James A. Leach, and Thomas J. Scalan. *Owning and Operating a Small Business: Strategies for Teaching Small Business Ownership and Management.* State Board of Education, Illinois Office of Education, June 1976.

E. *Small Marketers Aid No. 7.* "Checklist for Going into Business." Washington, D.C.: Small Business Administration, August 1970.

FREE ENTERPRISE SYSTEM
UNIT I

INFORMATION SHEET

I. Terms and definitions (Assignment Sheet #1)

   A. Competition — Effort of businesses or individuals acting independently to attract the consumers' dollars

   B. Entrepreneur — Person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit

   C. Free enterprise system — System that allows businesses and individuals to make their own choices about what they will do to earn a livelihood and how they will spend their money

   D. Free market system — System that allows consumers and producers freedom of choice, their choices determining what shall be produced, how much shall be produced, and the price to be paid

   E. Private property — Portion of a person's income that is kept in the form of savings, investments, or personal possessions

   F. Profit — Difference between selling price and expenses necessary to produce and sell goods and services

   (NOTE: Gross profit is what remains after the cost of the actual goods or services is subtracted from the selling price. Net profit is what remains after all expenses, such as advertising, rent, salaries, and depreciation, are subtracted.)

II. Essential components of the free enterprise system (Assignment Sheet #2)

   A. Private property

   B. Free markets

   C. Profit motivation

   D. Competition

III. Ways the free enterprise system affects consumers

   A. Private property — May provide earned income for consumer through profits made from investment

   EXAMPLE: A consumer may invest savings in the Angus Forklift Company; this creates the potential for the consumer to earn income through the profits of the company.

INFORMATION SHEET

B. Free markets — Allow consumers, through their buying decisions, to maintain the balance between supply and demand, and price of goods and services

EXAMPLE: When the Angus forklift was placed on the market, the supply was limited and the demand was high; the result was a high-priced forklift. A majority of consumers could not afford it. For this reason a large part of the market was not being reached. In response to this situation, the Angus Forklift Company produced several lower-priced forklifts.

C. Profit motivation — Consumers receive new and/or quality goods and services as a result of the desire for profit by business and industry

(NOTE: Business and industry are organizations that produce or distribute goods and services.)

EXAMPLE: The Angus forklift was an improvement on the conventional forklift and was produced as a result of a business' desire to increase profit.

D. Competition — Competition in business and industry results in reasonable prices and better-quality goods and services for consumers

EXAMPLE: The consumers' demand for the Angus forklift was high; as a result, several companies began to produce similar forklifts; the competition worked to keep down prices and resulted in many improvements in the forklift.

IV. Ways the free enterprise system affects business and industry

A. Private property — Business and industry can raise funds necessary for operation as a result of the private property invested by consumers

B. Free markets — Supply and price of goods and services are determined by consumer demand

EXAMPLE: The Angus forklift was in demand, but the majority of consumers could not afford the price; this demand resulted in the production of lower-priced forklifts. Other companies started to produce forklifts, so the supply was increased and price became even more reasonable.

C. Profit motivation — Encourages forming of businesses; provides goods and services; creates jobs

INFORMATION SHEET

D. Competition — Limits prices business and industry can demand for their goods and services

EXAMPLE: The Angus forklift was the only product of its type being produced for a period of time; several other companies soon began to produce similar equipment. This competition has made it necessary for all companies to keep prices competitive and has encouraged improvements in the forklift.

V. Production of goods and services in the free market system (Transparency #1; Assignment Sheet #3)

A. Goods and services — Goods are such items as clothes, food, houses, and automobiles; services are such items as medical care, hair care, dry cleaning, and airline transportation

B. Demand for goods and services — Consumers' desire to buy items such as clothing or medical care

C. Factors of production — Resources used by business and industry to produce goods and services

(NOTE: Four basic resources are used in the production of goods and services: land, labor, capital, and the entrepreneur.)

D. Payments for factors of production

(NOTE: Payments are in the form of rent, wages, interest, and dividends.)

VI. Characteristics of successful entrepreneurs (Assignment Sheets #4 and #5)

A. Ability to organize

B. Leadership ability

C. Ability to solve problems

D. Ability to make and be responsible for decisions

E. Enthusiasm and energy

F. Ability to communicate

G. Ability to work well with people

H. Willingness to work hard and long hours

I. Willingness to take risks

INFORMATION SHEET

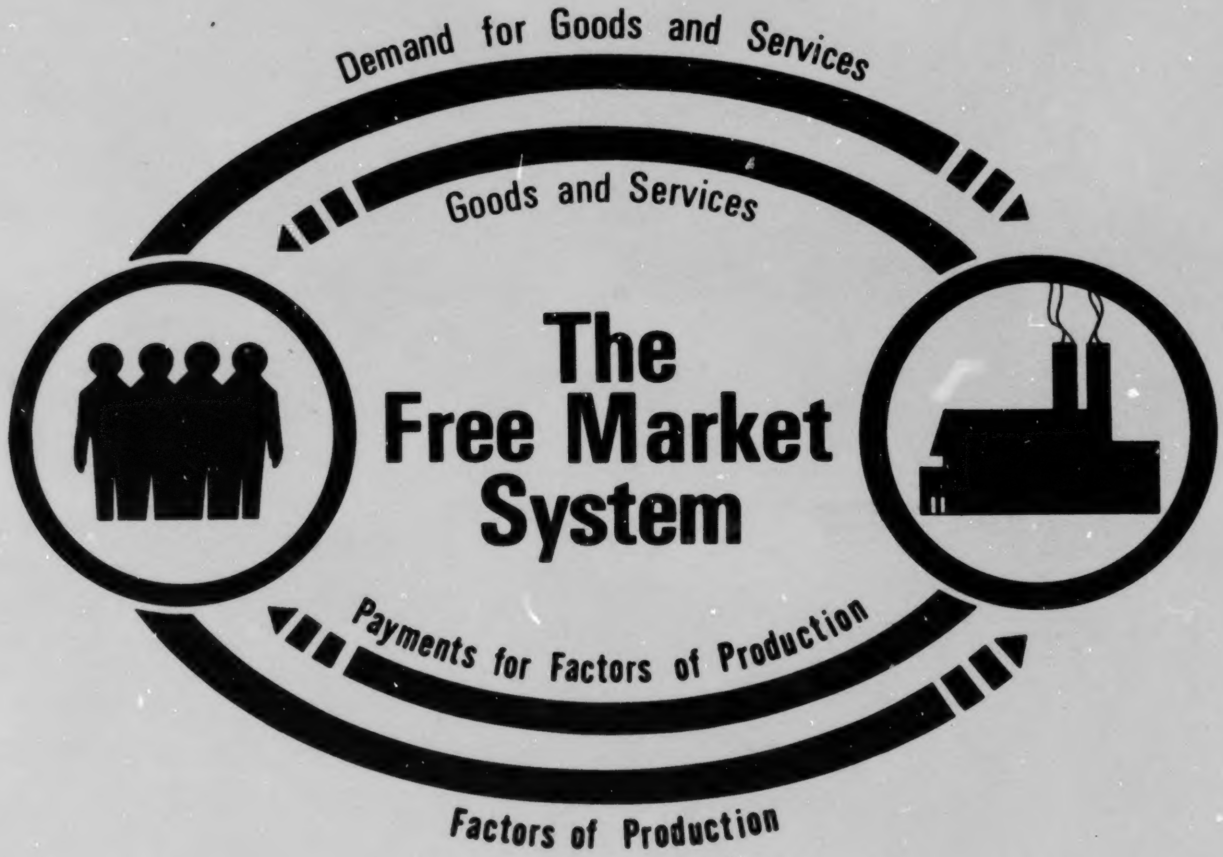
J. Independence

K. Possession of technical knowledge

L. Self-confidence

(NOTE: It is not necessary that a person possess all of these characteristics to be a successful entrepreneur, but a successful entrepreneur will posses the majority of them.)

The Free Market System


Demand for Goods and Services
Goods and Services
The Free Market System
Payments for Factors of Production
Factors of Production

FREE ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #1 — COMPLETE FREE ENTERPRISE SYSTEM CROSSWORD PUZZLE

NAME ________________________ SCORE __________

To be a productive worker in the bricklaying industry, you should be familiar with the terms and definitions associated with the free enterprise system.

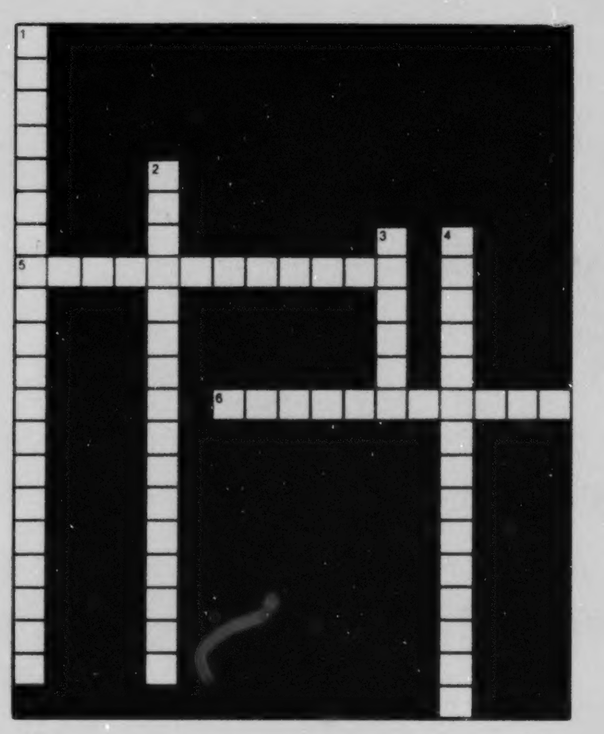
Use the clues below and Section I of your Information Sheet to complete the crossword puzzle on this page.

DOWN

1. System that allows businesses and individuals to make their own choices about what they will do to earn a livelihood and how they will spend their money (3 wds.)
2. System that allows consumers and producers freedom of choice, their choices determining what shall be produced, how much shall be produced, and the price to be paid (3 wds.)
3. Difference between selling price and expenses necessary to produce and sell goods and services
4. Portion of a person's income that is kept in the form of savings, investments, or personal possessions (2 wds.)

ACROSS

5. Person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit
6. Effort of businesses or individuals acting independently to attract the consumers' dollars



FREE ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #2 — ANALYZE COMPONENTS OF THE FREE ENTERPRISE SYSTEM

NAME ______________________________ SCORE ____________

By using the telephone book to analyze components of the free enterprise system, you will get a good idea of how many business firms are competing against each other for consumers' dollars.

A. Use the Yellow Pages of the telephone book to determine the number of business firms competing for consumers' dollars for the following goods and services. Write the names of the companies or businesses in the blanks provided.

1. Equipment rentals

a. ____________________ e. ____________________
b. ____________________ f. ____________________
c. ____________________ g. ____________________
d. ____________________ h. ____________________

2. Day nurseries and child-care centers

a. ____________________ f. ____________________
b. ____________________ g. ____________________
c. ____________________ h. ____________________
d. ____________________ i. ____________________
e. ____________________ j. ____________________

3. Income tax services

a. ____________________ d. ____________________
b. ____________________ e. ____________________
c. ____________________ f. ____________________

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ASSIGNMENT SHEET #2

4. Masonry equipment dealers

a. ____________________ d. ____________________

b. ____________________ e. ____________________

c. ____________________ f. ____________________

5. Telephone companies

a. ____________________ c. ____________________

b. ____________________ d. ____________________

6. Hospitals (general medical and services)

a. ____________________ c. ____________________

b. ____________________ d. ____________________

B. Analyze the information collected in the survey to answer the following questions.

1. Which business appears to have the most competition for consumers' dollars?

____

Explain your answer. ______________________________

____

____

2. How do most firms demonstrate the free market system?

____

____

____

3. What did the survey show you about profit motivation and business firms in your area?

____

____

____

ASSIGNMENT SHEET #2

4. What did the survey show about the use of private property by business?______

____

____

____

C. Read the following case studies that demonstrate how components of the free enterprise system are at work. Write an "X" in the blanks before the components you believe are at work, and explain your answers. More than one answer may be correct.

1. Jane Smith has $35,000 in savings and plans to use the money to start a masonry company. Jane conducted a survey of the people in the city in which she wants to locate the business. The survey shows a need for a masonry company, so Jane decides to open the business.

______a. Private property

Why? ______________________________________

____

____

______b. Free markets

Why? ______________________________________

____

____

______c. Profit motivation

Why? ______________________________________

____

____

______d. Competition

Why? ______________________________________

____

____

ASSIGNMENT SHEET #2

2. John Jones owns and operates a safety equipment and clothing store. John employs four salespeople and a stock clerk. He has decided to change his business from a full-service to a self-service store in an effort to lower expenses and increase profits. The number of employees will be reduced to two, a cashier and a stock person.

_____a. Private property

Why? ____

____

____

_____b. Free markets

Why? ____

____

____

_____c. Profit motivation

Why? ____

____

____

_____d. Competition

Why? ____

____

____

ASSIGNMENT SHEET #2

3. Pat James owns and operates a small brickyard. Pat has decided to increase the goods provided by the shop in an effort to increase sales. The goods that will be added are hand tools and equipment. Pat will have to borrow $10,000 from a relative to add these goods.

_____a. Private property

Why? ____

____

____

_____b. Free markets

Why? ____

____

____

_____c. Profit motivation

Why? ____

____

____

_____d. Competition

Why? ____

____

____

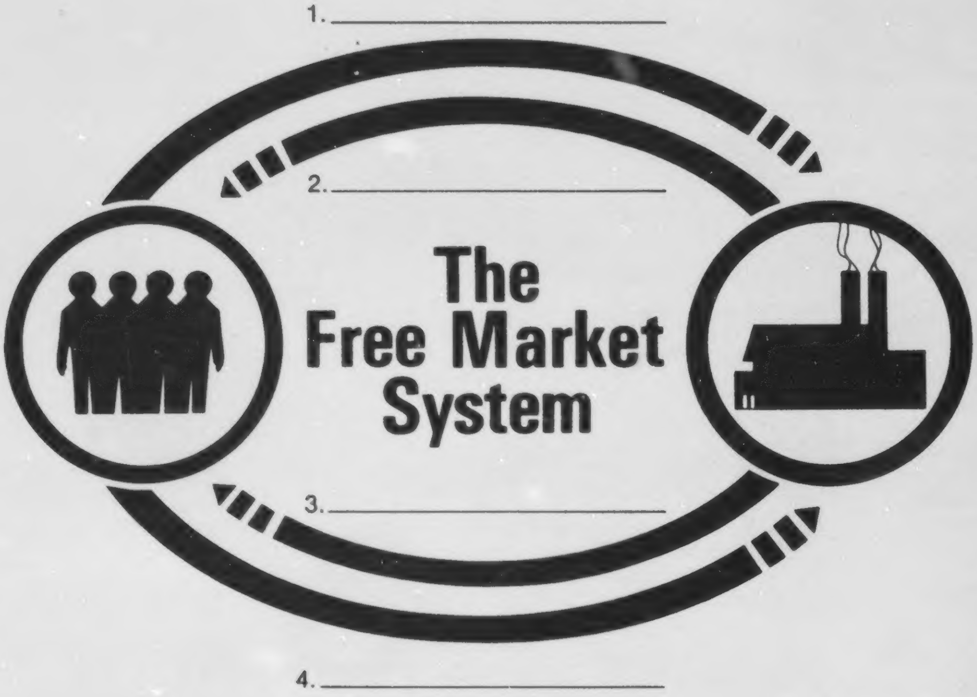
FREE ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #3 — INTERPRET A FLOW CHART FOR PRODUCTION OF GOODS AND SERVICES

NAME ____ SCORE ________________

Flow charts can be useful tools in analyzing the production flow of goods and services. Label the flow chart below, and then answer the questions that follow.

A. Label the flow chart below for the production of goods and services in the free market system.



ASSIGNMENT SHEET #3

B. How would the following changes within the free market system normally affect the flow chart for the production of goods and services? Write an "X" in the blank before each correct answer.

1. If consumer demand for goods and services increases and the business produces more goods and services, the business' demand for production resources will

   _____a. Increase

   _____b. Decrease

   _____c. Not change

2. If business demands more production resources and consumers supply more, payment to consumers for resources will

   _____a. Increase

   _____b. Decrease

   _____c. Not change

3. If consumer demand for goods and services increases, the amount of goods and services produced by business will

   _____a. Increase

   _____b. Decrease

   _____c. Not change

4. If business pays less for production resources, the amount paid by consumers should

   _____a. Increase

   _____b. Decrease

   _____c. Not change

5. If business produces fewer goods and services and consumers demand equally fewer goods and services, the cost paid by consumers for goods and services should

   _____a. Increase

   _____b. Decrease

   _____c. Not change

ASSIGNMENT SHEET #3

6. If consumers provide more production resources while business' demand for production resources remains the same, the amount business pays for resources will

______a. Increase

______b. Decrease

______c. Not change

FREE ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #4 — SURVEY LOCAL EQUIPMENT DEALERS

NAME ______________________________ SCORE ____________

The following survey will help you understand the rapid increase in products and the higher cost of living in the last few years.

Survey three local equipment dealers to determine why the cost of adjustable tower scaffolds increased so rapidly in the past four years.

EQUIPMENT DEALER	**REASONS GIVEN FOR RAPID INCREASE IN COST OF ADJUSTABLE TOWER SCAFFOLDS**
Dealer #1	
Dealer #2	
Dealer #3	

FREE ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #5 — DRAW A CONCLUSION ABOUT THE CHARACTERISTICS MOST IMPORTANT TO BEING A SUCCESSFUL ENTREPRENEUR

NAME ____________________________________ SCORE ______________

This exercise will give you a better view of what different people consider good characteristics of the successful entrepreneur.

A. Survey six individuals in your area to collect information about what they think the term *entrepreneur* means and what characteristics should be possessed to be a successful entrepreneur. This group should be comprised of two businesspeople, two adults who do not operate their own businesses, and two students not enrolled in this program.

PERSON SURVEYED	**MEANING OF ENTREPRENEUR**	**CHARACTERISTICS OF A SUCCESSFUL ENTREPRENEUR**
Businessperson #1		
Businessperson #2		
Student #1		
Student #2		
Adult #1		
Adult #2		

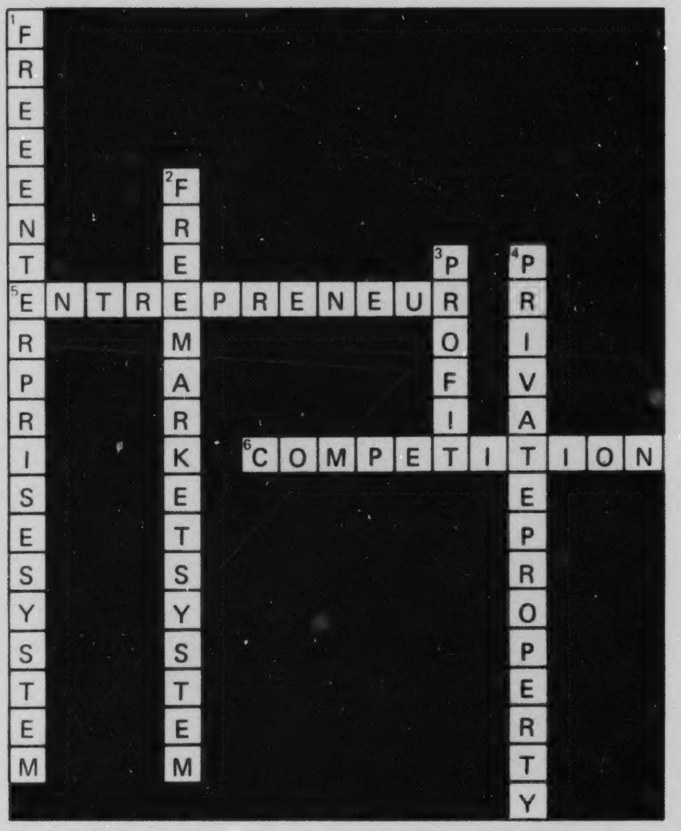
ASSIGNMENT SHEET #5

B. Consider the information obtained in the survey and the Information Sheet about the characteristics of a successful entrepreneur. In the space below, write what you believe to be the most important characteristics.

FREE ENTERPRISE SYSTEM
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1


1 FREEENTERPRISESYSTEM
2 FREEMARKETSYSTEM
3 PROFIT
4 PRIVATEPROPERTY
5 ENTREPRENEUR
6 COMPETITION

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

Assignment Sheet #3

A. 1. Demand for goods and services

2. Goods and services

3. Payments for factors of production

ANSWERS TO ASSIGNMENT SHEETS

4. Factors of production

B.
1. a
2. a
3. a
4. b
5. c
6. b

Assignment Sheet #4 — Evaluated to the satisfaction of the instructor

Assignment Sheet #5 — Evaluated to the satisfaction of the instructor

FREE ENTERPRISE SYSTEM
UNIT I

TEST

NAME ________________________________ SCORE ______________

1. Match terms associated with the free enterprise system to their correct definitions. Write the correct numbers in the blanks.

_____a. Person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit

_____b. Portion of a person's income that is kept in the form of savings, investments, or personal possessions

_____c. System that allows businesses and individuals to make their own choices about what they will do to earn a livelihood and how they will spend their money

_____d. Effort of businesses or individuals acting independently to attract the consumers' dollars

_____e. System that allows consumers and producers freedom of choice, their choices determining what shall be produced, how much shall be produced, and the price to be paid

_____f. Difference between selling price and expenses necessary to produce and sell goods and services

1. Free market system
2. Competition
3. Entrepreneur
4. Profit
5. Private property
6. Free enterprise system

2. Select from the following list the essential components of the free enterprise system. Write an "X" in the blank before each correct answer.

_____a. Public property

_____b. Profit motivation

_____c. Competition

_____d. Free markets

_____e. Assets

_____f. Private property

TEST

3. Discuss ways the free enterprise system affects consumers.

   a. Private property — ____________________

   b. Free markets — ____________________

   c. Profit motivation — ____________________

   d. Competition — ____________________

4. Discuss ways the free enterprise system affects business and industry.

   a. Private property — ____________________

   b. Free markets — ____________________

TEST

c. Profit motivation — ______________________________

____

____

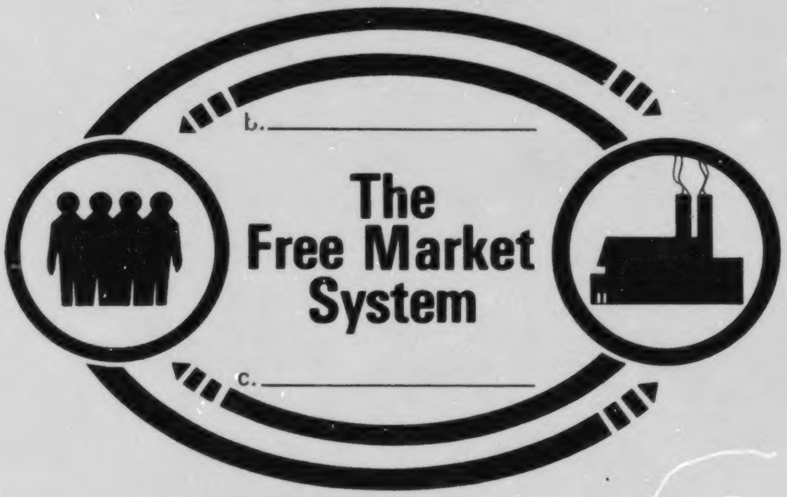
d. Competition — ______________________________

____

____

5. Label the flow chart below for production of goods and services in the free market system.

a. ____________________



d. ____________________

6. Select from the following list characteristics of successful entrepreneurs. Write an "X" in the blank before each correct answer.

_____a. Lack of self-confidence

_____b. Ability to organize

_____c. Leadership ability

_____d. Ill health

_____e. Ability to make and be responsible for decisions

TEST

_____f. Dependence on others

_____g. Enthusiasm and energy

_____h. Ability to communicate

_____i. Inability to deal with problems

_____j. Willingness to take risks

_____k. Possession of technical knowledge

_____l. Willingness to work hard and long hours

(NOTE: Test questions 7-10 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

7. Analyze components of the free enterprise system.
8. Interpret a flow chart for production of goods and services.
9. Survey local equipment dealers.
10. Draw a conclusion about the characteristics most important to being a successful entrepreneur.

FREE ENTERPRISE SYSTEM
UNIT I

ANSWERS TO TEST

1.	a.	3	d.	2
	b.	5	e.	1
	c.	6	f.	4

2. b, c, d, f

3. Discussion should include the following
    a. Private property — May provide earned income for consumer through profits made from investment
    b. Free markets — Allow consumers, through their buying decisions, to maintain the balance between supply and demand, and price of goods and services
    c. Profit motivation — Consumers receive new and/or quality goods and services as a result of the desire for profit by business and industry
    d. Competition — Competition in business and industry results in reasonable prices and better-quality goods and services for consumers

4. Discussion should include the following
    a. Private property — Business and industry can raise funds necessary for operation as a result of the private property invested by consumers
    b. Free markets — Supply and price of goods and services are determined by consumer demand
    c. Profit motivation — Encourages forming of businesses; provides goods and services; creates jobs
    d. Competition — Limits prices business and industry can demand for their goods and services

5. a. Demand for goods and services
    b. Goods and services
    c. Payments for factors of production

ANSWERS TO TEST

d. Factors of production

6. b, c, e, g, h, j, k, l

7. Evaluated to the satisfaction of the instructor

8. Evaluated to the satisfaction of the instructor

9. Evaluated to the satisfaction of the instructor

10. Evaluated to the satisfaction of the instructor

ECONOMICS OF FREE ENTERPRISE
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to analyze a supply and demand schedule, list factors that determine the degree of elasticity of demand, and interpret price factors that influence the economy. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with economics of free enterprise to their correct definitions.
2. Select from a list major characteristics of the modified free enterprise system.
3. Discuss roles of the government in the economy.
4. Match economic goals of American people to their correct descriptions.
5. Match production factors to their correct definitions.
6. Describe functions of supply and demand.
7. List factors that determine the degree of elasticity of demand.
8. Select from a list ways in which price factors influence the economy.
9. Collect information on government's role in the economy.
10. Analyze a supply and demand schedule.
11. Interpret price factors that influence the economy.

ECONOMICS OF FREE ENTERPRISE
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order films to supplement unit.

(NOTE: This series is available on a free-loan basis to Oklahoma teachers *only.* Oklahoma teachers may order the film from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state instructors must order from the address listed below.)

1. *American Enterprise Series: Land.* Color, 29 minutes, Modern Talking Picture Service, 1976. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.

2. *American Enterprise Series: Government.* Color, 29 minutes, Modern Talking Picture Service, 1976. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.

3. *American Enterprise Series: Innovation.* Color, 29 minutes, Modern Talking Picture Service, 1976. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.

B. Provide students with objective sheet.

C. Discuss unit and specific objectives.

D. Provide students with information and assignment sheets.

E. Discuss information and assignment sheets.

F. Arrange for a state senator or representative from your area to speak to the students on government's role in the economy.

(NOTE: Provide time for a question and answer session.)

G. Give test.

H. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

SUGGESTED ACTIVITIES

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment sheets

      1. Assignment Sheet #1 — Collect Information on Government's Role in the Economy

      2. Assignment Sheet #2 — Analyze a Supply and Demand Schedule

      3. Assignment Sheet #3 — Interpret Price Factors That Influence the Economy

   E. Answers to assignment sheets

   F. Test

   G. Answers to test

III. Unit references

   A. Broom, H.N., and Justin G. Longenecker. *Small Business Management*. Cincinnati, Ohio: South-Western Publishing Co., 1979.

   B. Nelson, Frank W. *Group Instruction for Cooperative Programs*. Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1978.

   C. Wyllie, Eugene D., and Roman F. Warmke. *Free Enterprise in the United States*. Cincinnati, Ohio: South-Western Publishing Co., 1980.

ECONOMICS OF FREE ENTERPRISE
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Allocation — Selection of the ways that production factors will be used to produce goods and services

B. Economics — Study of the process by which production factors are allocated to produce goods and services to satisfy the consumers' needs

C. Economic system — Process for allocation of production factors

EXAMPLES: Capitalism, socialism, communism

D. Economy — System for the production, distribution, and consumption of goods and services

E. Elastic demand — Change in price for a good or service that causes a considerable change in the quantity consumers will buy

F. Elasticity of demand — Effect that a change in the purchase price for a good or service has on the quantity that consumers will buy

G. Inelastic demand — Change in price for a good or service that does not cause a considerable change in the quantity consumers will buy

H. Modified free enterprise system — System in which businesses and individuals are not totally free to make their own choices about what they will do to earn a livelihood and how they will spend their money; laws at the federal, state, and local levels regulate these decisions

II. Major characteristics of the modified free enterprise system

A. Federal, state, and local governments influence how production factors will be used

B. Desire for profit is the primary motive for businesses and individuals

C. Competition promotes efficient methods of production and improvements in goods and services

D. Existence of some monopolistic business is permitted

(NOTE: A monopolistic business is one that is the only producer of a good or service. It has no competition.)

INFORMATION SHEET

E. The consumers' choices of what to buy determine the type and quantity of goods and services produced

F. Provides freedom of choice for employment, and grants the right to own property and to enter into contracts

G. System used to buy and sell goods and services

III. Roles of government in the economy (Assignment Sheet #1)

A. Producer and consumer of goods and services

(NOTE: By the collection of taxes, the government pays for production factors used in the production and delivery of goods and services.)

1. Federal government provides military defense, national parks and recreational facilities, interstate highways, Social Security, health care, postal service

2. State government provides state and interstate highways; educational facilities; state parks and recreational facilities; state police protection; assistance to the aged, handicapped, and disadvantaged; health care

3. Local government provides streets, water and sewer facilities, police and fire protection, libraries, health care

B. Regulator

1. Regulates and inspects goods and services

EXAMPLES: Federal Trade Commission, Environmental Protection Agency, Food and Drug Administration, Public Utilities Commission, Occupational Safety and Health Act, building codes

2. Establishes and enforces employment standards

EXAMPLES: National Labor Relations Board, Equal Employment Opportunity Commission, Wage and Salary Administration

3. Regulates business, particularly large businesses

EXAMPLES: Securities and Exchange Commission, Federal Communications Commission, Federal Reserve Board

INFORMATION SHEET

IV. Economic goals of American people

(NOTE: In a free enterprise system people are free to determine their own goals. People set their own goals and use production factors to fulfill their wants and needs. People have individual wants and needs, but Americans in general have certain economic goals.)

A. Economic freedom — Having free choice in making economic decisions

EXAMPLES: Freedom to start a business, buy a new car, add a room onto the house, put money into a savings account

B. Economic efficiency — Using production factors in the most efficient manner

C. Economic growth — Having an ever-increasing standard of living

EXAMPLES: Better medical care, housing, clothing, education, highways, salaries, police protection

D. Economic stability — Avoiding economic ups and downs, such as inflation, recession, and depression

E. Economic security — Having a certain minimum standard of living

EXAMPLES: Social Security, Medicare, government work programs, unemployment compensation insurance, price supports, welfare benefits, food stamps

F. Economic justice — Having fair distribution of the national wealth based on productivity

V. Production factors

A. Land — Consists of such items as land, water, oil, natural gas, coal, and uranium

(NOTE: Land is sometimes referred to as *natural resources*.)

B. Labor — Physical and mental effort used in the production of goods and services

C. Capital — Investment in buildings and equipment used to produce goods and services

D. Entrepreneur — Person who develops ideas for goods and services, organizes and operates a business to produce or sell goods and services, makes decisions for a business, and assumes risks for success or failure of a business

INFORMATION SHEET

VI. Functions of supply and demand (Assignment Sheet #2)

A. Supply — Quantity of a good or service that producers are willing and able to make available for consumers to buy at a specific price and time

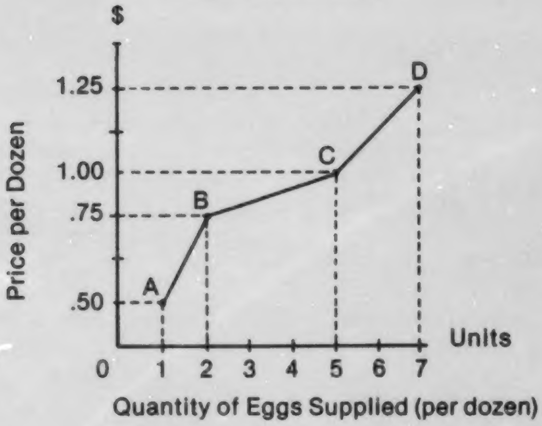
(NOTE: Supply schedules and supply curves are two ways of showing supply information.)

EXAMPLES:

SUPPLY SCHEDULE

Price of Eggs (per Dozen)	Quantity of Eggs Supplied at That Price (per Dozen)	Points on Supply Curve
$ .50	1	A
$ .75	2	B
$1.00	5	C
$1.25	7	D

SUPPLY CURVE



(NOTE: Price is always shown on the vertical axis. Quantity is always shown on the horizontal axis. Points on the supply curve are located by use of a supply schedule. Supply is normally graphed as an upsloping line because more is produced as price goes up.)

INFORMATION SHEET

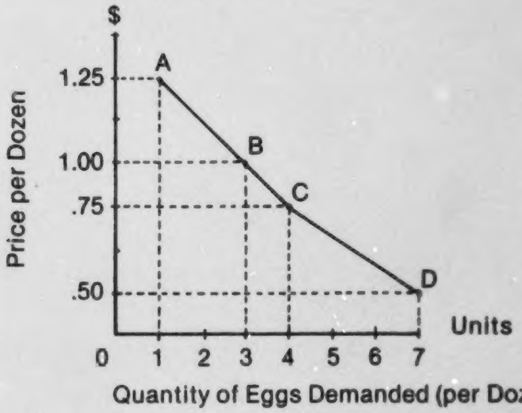
B. Demand — Quantity of a good or service that consumers are willing and able to buy at a specific price and time

(NOTE: Demand schedules and demand curves are two ways of showing demand information.)

EXAMPLES:

DEMAND SCHEDULE		
Price of Eggs (per Dozen)	Quantity of Eggs Demanded at That Price (per Dozen)	Points on Demand Curve
$1.25	1	A
$1.00	3	B
$ .75	4	C
$ .50	7	D

DEMAND CURVE



(NOTE: Price is always shown on the vertical axis. Quantity is always shown on the horizontal axis. Points on a demand curve are located by use of a demand schedule. Demand is normally graphed as a downsloping line because more is purchased as price goes down.)

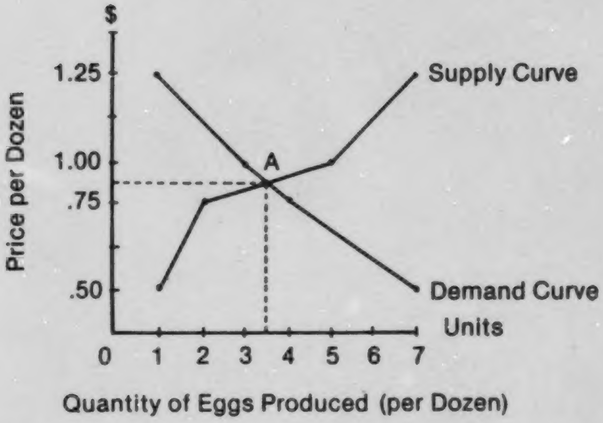
INFORMATION SHEET

C. Supply and demand — Determines the price and number of goods or services that will be produced

EXAMPLES:

SUPPLY AND DEMAND SCHEDULE		
Price of Eggs (per Dozen)	Quantity of Eggs Demanded at That Price (per Dozen)	Quantity of Eggs Demanded at That Price
$ .50	1	7
$ .75	2	4
$1.00	5	3
$1.25	7	1

SUPPLY AND DEMAND CURVE



(NOTE: Point A is the price where all the eggs produced will be sold.)

INFORMATION SHEET

VII. Factors that determine the degree of elasticity of demand

- A. Whether a good or service is a necessity or a luxury

  (NOTE: The demand for luxury goods and services is more elastic than the demand for necessary goods and services.)

  EXAMPLE: If the price of air-conditioning equipment increases, the demand will decrease considerably; if the price of electricity increases, the demand will not decrease.

- B. Availability of substitute products

  EXAMPLE: If the price of hydraulic equipment increases, consumers will go back to mechanical equipment.

- C. Amount of money consumers have available and are willing to spend

VIII. Ways in which price factors influence the economy (Assignment Sheet #3)

- A. Price determines what will be produced by showing what goods and services are profitable

  EXAMPLE: If the price of sand is $3.75 per ton, and it costs the contractor $4.25 per ton to excavate, sand is not a profitable product for the contractor. The contractor will have to consider producing another product, such as gravel.

- B. Price determines allocation of scarce resources

  EXAMPLE: If diesel fuel is selling for $1.15 per gallon and kerosene is selling for $.90 per gallon, oil will be used primarily to produce diesel fuel.

  (NOTE: The producer will produce the product that will show him or her the most profit.)

- C. Price determines methods of production for a good or service

  EXAMPLE: If a home contractor can use a cheaper grade block to build a home and the consumer does not care, the contractor can reduce the cost of the product.

- D. Price determines what consumers are able to buy

  EXAMPLE: If the consumer's income is $20,000 per year, the consumer will not be able to buy a $250,000 home.

INFORMATION SHEET

E. Price influences consumers' decisions about what goods or services to buy

EXAMPLE: A brick contractor is shopping to buy a masonry saw and has found two that he or she would like to buy; all other things equal, the contractor will buy the lowest-priced masonry saw.

F. Consumers' collective buying decisions determine the price for goods and services

EXAMPLE: Ten years ago, large American automobiles were selling for a much lower price than foreign automobiles. Today consumers are purchasing more foreign automobiles. This demand has caused the price and supply of foreign automobiles to rise rapidly; the price of American automobiles has increased but at a much slower rate.

G. Marketing surveys and reviews of past sales records determine what goods and services consumers will buy and what price consumers will pay

ECONOMICS OF FREE ENTERPRISE
UNIT II

ASSIGNMENT SHEET #1 — COLLECT INFORMATION ON GOVERNMENT'S ROLE IN THE ECONOMY

NAME ______________________ SCORE __________

This exercise will help you become more familiar with the functions of the different government agencies and their roles in the economy.

PART I

Interview or contact by letter at least one agency from each of the following levels of government to determine the functions the agency performs. Use the questions included in this assignment to complete the interviews.

A. *Federal*

EXAMPLES: Federal Trade Commission
Food and Drug Administration
United States Postal Service
Occupational Safety and Health Administration (OSHA)
Department of Labor — Wage and Hour Administration
Social Security Administration

1. With what type of business does the agency work? ______________________

____

____

____

2. What goods or services does the agency provide to these businesses? ________

____

____

____

3. What regulatory and/or protective functions are performed for these businesses?

____

____

____

ASSIGNMENT SHEET #1

B. *State*

EXAMPLES: Department of Human Services (welfare office)
State Employment Office
State Highway Department
State Department of Health
Department of Consumer Affairs
Corporation Commission

1. With what type of business does the agency work?__________________

____

____

____

2. What goods or services does the agency provide to these businesses?______

____

____

____

3. What regulatory and/or protective functions are performed for these businesses?

____

____

____

C. *County or City*

EXAMPLES: Board of County Commissioners
County Clerk
County Tax Assessor
County Surveyor
Highway Inspector
Buildings and Codes Department
City Engineer

ASSIGNMENT SHEET #1

1. With what type of business does the agency work?______________________

2. What goods or services does the agency provide to these businesses?______

3. What regulatory and/or protective functions are performed for these businesses?

PART II

Interview at least two people from the following types of businesses. Use the forms that follow to complete your interviews.

Bank or savings and loan company

Masonry contractor

Building contractor

Day care center

Telephone company

Gas company or electric company

Hospital or nursing home

Demolition contractor

Manufacturing business

ASSIGNMENT SHEET #1

A. Type of business ______________________________

B. Name of business ______________________________

1. What goods or services are provided for the business by the following levels of government?

   a. Federal — ______________________________

   b. State — ______________________________

   c. County or city — ______________________________

2. How is this business affected by the regulatory functions performed by levels of government?

   a. Federal — ______________________________

   b. State — ______________________________

ASSIGNMENT SHEET #1

c. County or city — ____________________

A. Type of business____________________

B. Name of business____________________

1. What goods or services are provided for the business by the following levels of government?

   a. Federal — ____________________

   b. State — ____________________

   c. County or city — ____________________

2. How is this business affected by the regulatory functions performed by levels of government?

   a. Federal — ____________________

ASSIGNMENT SHEET #1

b. State — ____

____

____

____

c. County or city — ____________________________________

____

____

____

ECONOMICS OF FREE ENTERPRISE
UNIT II

ASSIGNMENT SHEET #2 — ANALYZE A SUPPLY AND DEMAND SCHEDULE

NAME ________________________________ SCORE ______________

By analyzing a supply and demand schedule you will learn more about how prices are set and how demand determines the amount to produce.

The XYZ Tire Company has conducted a survey to determine the number of tires to produce and the price to charge. The results of the survey have been placed in the following supply and demand schedule.

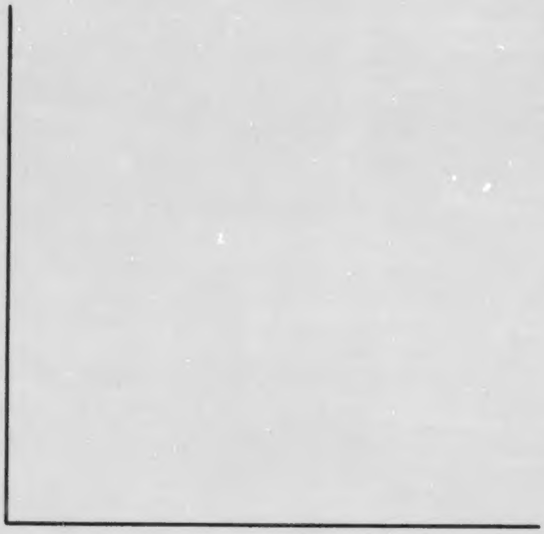
SUPPLY AND DEMAND SCHEDULE

Price of Tires	Number of Tires Supplied at That Price	Number of Tires Demanded at That Price
$ 75.00	300,000	1,000,000
$100.00	500,000	900,000
$125.00	650,000	850,000
$150.00	700,000	800,000
$175.00	800,000	700,000
$200.00	950,000	600,000
$225.00	1,000,000	400,000

A. Construct a supply curve using the information in the supply and demand schedule.

ASSIGNMENT SHEET #2

B. Construct a demand curve using the information in the supply and demand schedule.



C. Construct a supply and demand curve using the information in the supply and demand schedule.

ASSIGNMENT SHEET #2

D. Analyze the supply and demand curve and answer the following questions.

1. How many tires will be produced?____________________________________

2. What will be the price of the tires?____________________________________

ECONOMICS OF FREE ENTERPRISE
UNIT II

ASSIGNMENT SHEET #3 — INTERPRET PRICE FACTORS THAT INFLUENCE THE ECONOMY

NAME ______________________________ SCORE ______________

Understanding the economics of free enterprise is important to all producers and consumers in a free enterprise system. This exercise will help you understand how price factors influence the economy.

A. The Bench Brick Company is planning to add one more item to the line it sells. The store can sell ceramic tile or glazed tile. The store estimates that 40,000 ceramic tiles can be sold at a profit of 10 cents per tile, and 38,000 glazed tiles can be sold at a profit of 12 cents per tile.

1. Which item should the Bench Brick Company select to sell?

____

2. Explain your decision. ______________________________

____

____

3. Which price factor was used to make your decision? ______________

____

____

____

B. John and Susan Johnson are planning to buy a new business. They have looked at two that they like. The businesses are basically the same, except A is located on five acres of land and B is located on a 100-by-100-foot lot. The monthly payments on A are $500. The monthly payments on B are $300. Based on their monthly income and their other financial obligations, the Johnsons decided they could not afford to buy A.

Which factor of price influenced the Johnsons' decision to buy B?

____

____

____

ASSIGNMENT SHEET #3

C. A few years ago there was a shortage of coffee in America. Because of this shortage, the coffee companies raised prices. Consumers objected to the price increase and began using less coffee. The decrease in the use of coffee affected the coffee companies' profits to the point that they decided to lower prices to a more reasonable level.

Which price factor influenced the coffee companies' decision to lower coffee prices?

____

____

____

D. The Miller Clothing Company has decided to conduct a marketing survey and to review the previous year's sales records for safety clothes. The purpose of the survey and review is to determine the style of safety clothes consumers will buy and the price consumers will pay.

Which price factor influenced the company's decision to conduct a survey and review the sales records? ________________________________

____

____

ECONOMICS OF FREE ENTERPRISE
UNIT II

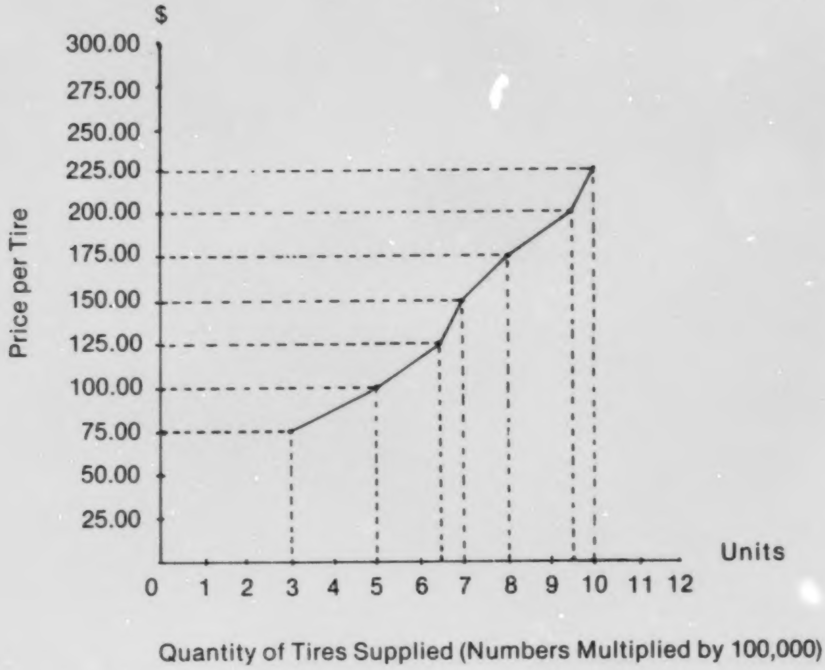
ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 — Evaluated to the satisfaction of the instructor

Assignment Sheet #2

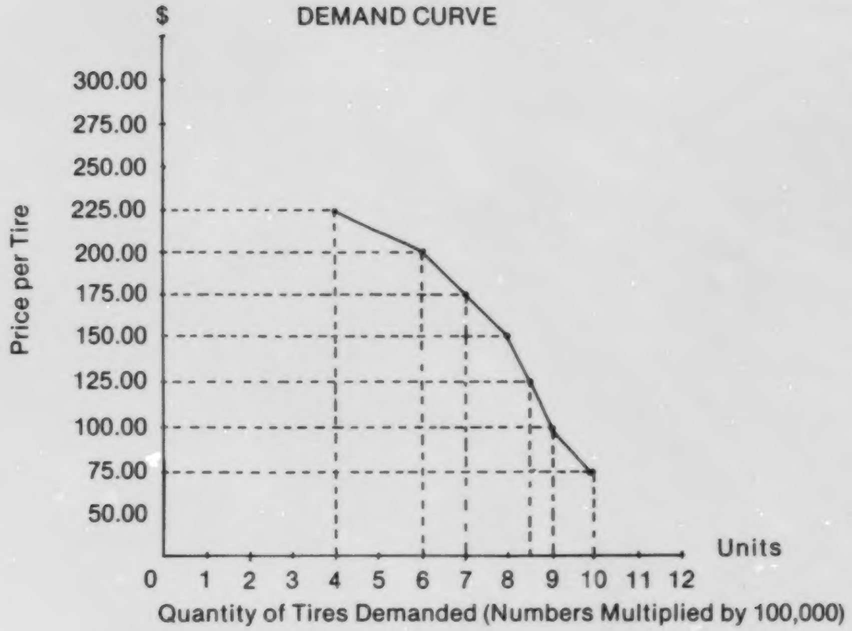
A.

SUPPLY CURVE

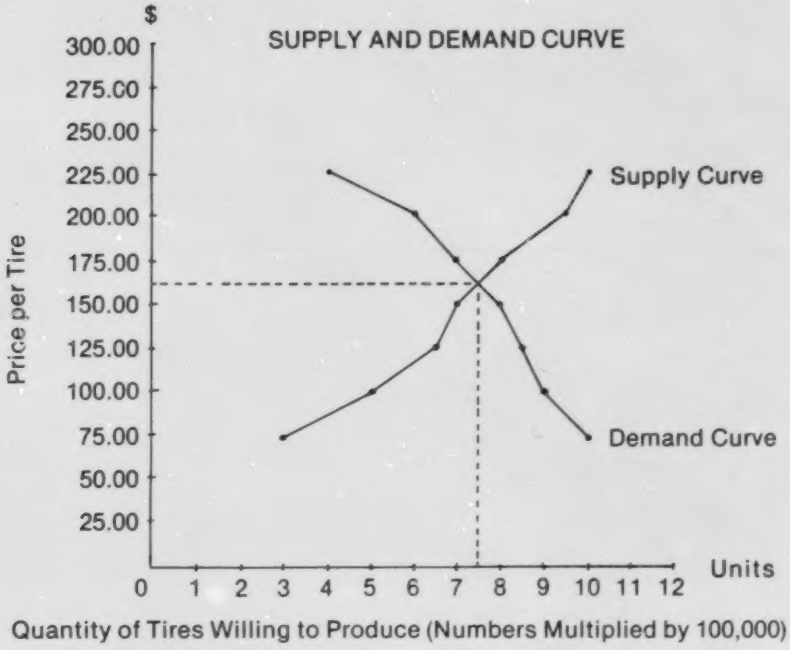


ANSWERS TO ASSIGNMENT SHEETS

B.



C.



ANSWERS TO ASSIGNMENT SHEETS

D. 1. 750,000 tires

2. \$163.00

Assignment Sheet #3

A. 1. Glazed tile

2. The profit from the sale of glazed tile equals \$4,560, and the profit from the sale of ceramic tile equals \$4,000. The sale of glazed tile would result in an additional \$560 profit.

3. Price determines what will be produced by showing what goods and services are profitable

B. Price determines what consumers are able to buy

C. Consumers' collective buying decisions determine the price for goods and services

D. Marketing surveys and reviews of past sales records determine what goods and services consumers will buy and what price consumers will pay

BLC - 65-A

ECONOMICS OF FREE ENTERPRISE
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with economics of free enterprise to their correct definitions. Write the correct numbers in the blanks.

______a. System in which businesses and individuals are not totally free to make their own choices about what they will do to earn a livelihood and how they will spend their money; laws at the federal, state, and local levels regulate these decisions

______b. System for the production, distribution, and consumption of goods and services

______c. Process for allocation of production factors

______d. Study of the process by which production factors are allocated to produce goods and services to satisfy the consumers' needs

______e. Selection of the ways that production factors will be used to produce goods and services

______f. Effect that a change in the purchase price for a good or service has on the quantity that consumers will buy

______g. Change in price for a good or service that causes a considerable change in the quantity consumers will buy

______h. Change in price for a good or service that does not cause a considerable change in the quantity consumers will buy

1. Allocation
2. Inelastic demand
3. Economy
4. Elastic demand
5. Elasticity of demand
6. Economic system
7. Economics
8. Modified free enterprise system

2. Select from the following list major characteristics of the modified free enterprise system. Write an "X" in the blank before each correct answer.

______a. Competition promotes efficient methods of production and improvements in goods and services

______b. The producers' choices of what to buy determine the type and quantity of goods and services produced

TEST

______c. Desire for profit is the primary motive for businesses and individuals

______d. Federal, state, and local governments control how production factors will be used

______e. Provides freedom of choice for employment, and grants the right to own property and to enter into contracts

______f. Existence of some monopolistic business is permitted

______g. System used to buy and sell goods and services

3. Discuss roles of the government in the economy.

   a. Producer and consumer of goods and services

      1) ____
      ____
      ____
      ____

      2) ____
      ____
      ____
      ____

      3) ____
      ____
      ____

   b. Regulator

      1) ____

      2) ____

      3) ____

TEST

4. Match economic goals of American people to their correct descriptions. Write the correct numbers in the blanks.

______a. Having free choice in making economic decisions

______b. Using production factors in the most efficient manner

______c. Having an ever-increasing standard of living

______d. Avoiding economic ups and downs, such as inflation, recession, and depression

______e. Having a certain minimum standard of living

______f. Having fair distribution of the national wealth based on productivity

1. Economic efficiency
2. Economic justice
3. Economic freedom
4. Economic growth
5. Economic stability
6. Economic security

5. Match production factors to their correct definitions. Write the correct numbers in the blanks.

______a. Consists of such items as land, water, oil, natural gas, coal, and uranium

______b. Investment in buildings and equipment used to produce goods and services

______c. Person who develops ideas for goods and services, organizes and operates a business to produce or sell goods and services, makes decisions for a business, and assumes risks for success or failure of a business

______d. Physical and mental effort used in the production of goods and services

1. Capital
2. Labor
3. Land
4. Entrepreneur

6. Describe functions of supply and demand.

a. Supply — ____

____

____

TEST

b. Demand — ____________________

____

____

c. Supply and demand — ____________________

____

____

7. List factors that determine the degree of elasticity of demand.

a. ____________________

b. ____________________

c. ____________________

8. Select from the following list ways in which price factors influence the economy. Write an "X" in the blank before each correct answer.

_____a. Price determines what will be produced by showing what goods and services are profitable

_____b. Consumers' individual buying decisions determine the price for goods and services

_____c. Price determines methods of production for a good or service

_____d. Price determines allocation of scarce resources

_____e. Price does not influence consumers' decisions about what goods or services to buy

_____f. Price determines what consumers are able to buy

_____g. Marketing surveys and reviews of past sales records determine what goods and services consumers will buy and what price consumers will pay

(NOTE: Test questions 9-11 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

9. Collect information on government's role in the economy.

10. Analyze a supply and demand schedule.

11. Interpret price factors that influence the economy.

ECONOMICS OF FREE ENTERPRISE
UNIT II

ANSWERS TO TEST

1.

a.	8	e.	1
b.	3	f.	5
c.	6	g.	4
d.	7	h.	2

2. a, c, e, f, g

3. Discussion should include the following

    a. Producer and consumer of goods and services

        1) Federal government provides military defense, national parks and recreational facilities, interstate highways, Social Security, health care, postal service

        2) State government provides state and interstate highways; educational facilities; state parks and recreational facilities; state police protection; assistance to the aged, handicapped, and disadvantaged; health care

        3) Local government provides streets, water and sewage facilities, police and fire protection, libraries, health care

    b. Regulator

        1) Regulates and inspects goods and services

        2) Establishes and enforces employment standards

        3) Regulates business, particularly large businesses

4.

a.	3	d.	5
b.	1	e.	6
c.	4	f.	2

ANSWERS TO TEST

5. a. 3

   b. 1

   c. 4

   d. 2

6. Description should include the following

   a. Supply — Quantity of a good or service that producers are willing and able to make available for consumers to buy at a specific price and time

   b. Demand — Quantity of a good or service that consumers are willing and able to buy at a specific price and time

   c. Supply and demand — Determines the price and number of goods or services that will be produced

7. a. Whether a good or service is a necessity or a luxury

   b. Availability of substitute products

   c. Amount of money consumers have available and are willing to spend

8. a, c, d, f, g

9. Evaluated to the satisfaction of the instructor

10. Evaluated to the satisfaction of the instructor

11. Evaluated to the satisfaction of the instructor

INDUSTRY ORIENTATION
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to list facts concerning the occupation of bricklayer and occupational outlook for bricklayers. The student should also be able to list requirements and major skills needed by the bricklayer. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with industry orientation to their correct definitions.
2. List facts concerning occupational outlook for bricklayers.
3. Name employment opportunities for bricklayers.
4. Select from a list guidelines for the bricklaying program.
5. State characteristics of a good bricklayer.
6. Name major skills involved in bricklaying program.
7. Complete employment application.
8. Complete a W-4 form.
9. Practice interview questions.
10. Compare job opportunities.

INDUSTRY ORIENTATION
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Provide students with objective sheet.

   B. Discuss unit and specific objectives.

   C. Provide students with information and assignment sheets.

   D. Discuss information and assignment sheets.

   E. Divide the class into groups of two or three. Have each group role-play an interview, with students taking turns being the employer and the applicant. Use the questions in Assignment Sheet #3.

   F. Invite a masonry contractor to talk with the class about opportunities for employment in the local community.

   G. Give test.

   H. Complete appropriate section of competency profiles.

   (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment sheets

      1. Assignment Sheet #1 — Complete Employment Application

      2. Assignment Sheet #2 — Complete a W-4 Form

      3. Assignment Sheet #3 — Practice Interview Questions

      4. Assignment Sheet #4 — Compare Job Opportunities

   E. Answers to assignment sheets

   F. Test

   G. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

A. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Material, Vol. I.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1981.

B. *Occupational Outlook Handbook,* Bulletin No. 1650. Washington, D.C.: U.S. Department of Labor Statistics, 1970-71.

INDUSTRY ORIENTATION
UNIT III

INFORMATION SHEET

I. Terms and definitions

  A. Bricklayer — Person employed to perform skills of bricklaying trade

  B. Construction industry — Large-scale enterprise relating to crafts and skills of industrial and commercial construction

  C. Job — Work done in return for pay

  D. Occupation — Skilled activity that is the principal business of one's life

  E. Refractory industry — Enterprise dealing with heat-resistant materials such as firebrick for furnaces and fireplaces

  F. Skill — Ability or proficiency gained by training, practice, or special experience

  G. Subcontractor — Person or firm that agrees to perform part, or all, of another's contract

  H. Trade — Group of related skills within an occupation

II. Facts concerning occupational outlook for bricklayers

  A. Specialization and new concepts in masonry construction create job opportunities

  B. Increased population creates increased employment opportunities

  C. Construction industry needs more bricklayers each year to build more and larger projects

  D. Mortality and retirement of experienced bricklayers open up employment opportunities

III. Employment opportunities for bricklayers (Assignment Sheet #4)

  A. Independent and union-affiliated residential contractors

  B. Independent and union-affiliated commercial contractors

  C. Prefabrication industry

  D. Refractory industry

INFORMATION SHEET

E. Remodeling work

F. Instructors for training and apprenticeship programs

G. Restoration of museums, landmarks, and old communities

IV. Guidelines for the bricklaying program

A. Be safety conscious and follow safety regulations

B. Use all tools properly and proficiently

C. Be responsible

D. Have a complete set of hand tools

V. Characteristics of a good bricklayer (Assignment Sheets #1-#3)

(NOTE: It is impossible to cover every phase of safety and hazardous conditions; therefore, knowledge and adaptation of basic rules will help to develop good and safe habits.)

A. Checks all equipment before starting work

B. Operates all power equipment correctly

C. Is safety conscious and follows safety regulations

D. Practices conservation of materials and equipment

E. Takes instructions readily and follows company rules

F. Displays enthusiasm about job

G. Exhibits pride in the trade

H. Is punctual

I. Is a good citizen

J. Shows initiative

K. Cooperates

VI. Major skills involved in bricklaying program

A. Measuring

B. Math

INFORMATION SHEET

C. Reading construction plans

D. Layout

E. Estimating materials

F. Use of hand tools

G. Use of power tools and equipment

H. Construction

I. Welding and cutting

INDUSTRY ORIENTATION
UNIT III

ASSIGNMENT SHEET #1 — COMPLETE EMPLOYMENT APPLICATION

NAME ______________________________ SCORE ______________

This employment application will give you the opportunity to see what an application looks like and give you a chance to fill one out before you actually apply for a position.

Complete the following application form, using guidelines below and information about yourself.

(NOTE: Although each business uses its own form, general rules of preparation apply to any form.)

A. Be prepared

   1. Take a good pen

   2. Take copies of résumé

B. Look over entire form before starting to write; do not hurry

C. Follow directions

   1. Note whether information is to be printed or written

   2. Carry out all directions

D. Write clearly, neatly, and legibly

E. Answer briefly

F. Be honest

G. Answer all questions

   (NOTE: If questions do not apply to you, write *NOT APPLICABLE* or *N/A* in the space to show that you did not overlook the question.)

H. Include complete information

I. Recheck application when finished

J. Avoid crossing out and erasing

K. Use the word *open* for question about minimum salary since most employers pay standardized rates and will not negotiate on salary

BLC - 81-A

ASSIGNMENT SHEET #1

"WE ARE AN EQUAL OPPORTUNITY EMPLOYMENT COMPANY. WE ARE DEDICATED TO A POLICY OF NON-DISCRIMINATION IN EMPLOYMENT ON ANY BASIS INCLUDING RACE, CREED, COLOR, AGE, SEX, RELIGION OR NATIONAL ORIGIN OR PHYSICAL DEFECTS."

APPLICATION FOR EMPLOYMENT

LAST

FIRST

MIDDLE

PERSONAL INFORMATION

DATE

NAME
LAST FIRST MIDDLE

PRESENT ADDRESS
STREET CITY STATE ZIP

PERMANENT ADDRESS
STREET CITY STATE ZIP

PHONE NO. SOCIAL SECURITY NUMBER

REFERRED BY

EMPLOYMENT DESIRED

POSITION DATE YOU CAN START SALARY DESIRED

ARE YOU EMPLOYED NOW? IF SO, MAY WE INQUIRE OF YOUR PRESENT EMPLOYER

EVER APPLIED TO THIS COMPANY BEFORE? WHERE WHEN

EDUCATION	NAME AND LOCATION OF SCHOOL	YEARS ATTENDED	DATE GRADUATED	SUBJECTS STUDIED
GRAMMAR SCHOOL				
HIGH SCHOOL				
COLLEGE				
TRADE, BUSINESS, OR CORRESPONDENCE SCHOOL				

SUBJECTS OF SPECIAL STUDY OR RESEARCH WORK

U.S. MILITARY OR NAVAL SERVICE RANK PRESENT MEMBERSHIP IN NATIONAL GUARD OR RESERVES

ACTIVITIES OTHER THAN RELIGIOUS (CIVIC, ATHLETIC, FRATERNAL, ETC.)

Exclude organizations, the name or character of which indicates the race, creed, color, or national origin of its members.

(CONTINUED ON OTHER SIDE)

ASSIGNMENT SHEET #1

FORMER EMPLOYERS (LIST BELOW LAST FOUR EMPLOYERS, STARTING WITH LAST ONE FIRST.)

DATE MONTH & YEAR	NAME AND ADDRESS OF EMPLOYER	SALARY	POSITION	REASON FOR LEAVING
FROM				
TO				
FROM				
TO				
FROM				
TO				
FROM				
TO				

REFERENCES: Give below the names of two persons not related to you, whom you have known at least one year.

	NAME	ADDRESS	BUSINESS	YEARS ACQUAINTED
1				
2				

PHYSICAL RECORD:
List any physical defects

WERE YOU EVER INJURED? GIVE DETAILS

HAVE YOU ANY DEFECTS IN HEARING? IN VISION? IN SPEECH?

IN CASE OF EMERGENCY NOTIFY
NAME ADDRESS PHONE NO.

I AUTHORIZE INVESTIGATION OF ALL STATEMENTS CONTAINED IN THIS APPLICATION. I UNDERSTAND THAT MISREPRESENTATION OR OMISSION OF FACTS CALLED FOR IS CAUSE FOR DISMISSAL. FURTHER, I UNDERSTAND AND AGREE THAT MY EMPLOYMENT IS FOR NO DEFINITE PERIOD AND MAY, REGARDLESS OF THE DATE OF PAYMENT OF MY WAGES AND SALARY, BE TERMINATED AT ANY TIME WITHOUT ANY PREVIOUS NOTICE.

DATE SIGNATURE

DO NOT WRITE BELOW THIS LINE

TO BE COMPLETED DAY EMPLOYMENT BEGINS DATE

HEIGHT WEIGHT AGE DATE OF BIRTH

SINGLE MARRIED WIDOWED CITIZEN U.S.A. SEX

THE ABOVE INFORMATION NEEDED FOR PENSION, HOSPITALIZATION, INSURANCE, ETC., AND NOT FOR HIRING PURPOSES

INTERVIEWED BY DATE REMARKS

NEATNESS		CHARACTER	
PERSONALITY		ABILITY	

HIRED FOR DEPT. POSITION WILL REPORT SALARY WAGES

APPROVED: 1. 2. 3.
EMPLOYMENT MANAGER DEPT. HEAD GENERAL MANAGER

INDUSTRY ORIENTATION
UNIT III

ASSIGNMENT SHEET #2 — COMPLETE A W-4 FORM

NAME ______________________________ SCORE ______________

The law requires that any working person must complete a W-4 form so that employers can withhold federal income tax from employees' pay. Your W-4 form remains in effect until you change it or, if you entered "Exempt" on line 6b, until February 15 of next year. By correctly completing this form, you can fit the amount of tax withheld from your wages to your tax liability.

Complete the following form, using guidelines below and information about yourself.

A. Be prepared

B. Follow directions

C. Write or print clearly, neatly, and legibly

D. Answer all questions honestly

E. Include complete information

F. Recheck form when finished

G. Avoid crossing out and erasing

H. Do not mark in boxes #7, #8, and #9

I. When you are sure the form is correct and complete, detach at the perforated line and give the top part to your employer; keep the lower part for your records and information

BLC - 85-A

ASSIGNMENT SHEET #2

Form **W-4**
(Rev. January 1982)

Department of the Treasury—Internal Revenue Service

Employee's Withholding Allowance Certificate

OMB No. 1545-0010
Expires 4-[illegible]-83

1 Type or print your full name

2 Your social security number

Home address (number and street or rural route)

City or town, State, and ZIP code

3 Marital Status ☐ Single ☐ Married
☐ Married, but withhold at higher Single rate
Note: If married, but legally separated, or spouse is a nonresident alien, check the Single box.

4 Total number of allowances you are claiming (from line F of the worksheet on page 2) . . . .

5 Additional amount, if any, you want deducted from each pay . . . . $

6 I claim exemption from withholding because (see instructions and check boxes below that apply):

a ☐ Last year I did not owe any Federal income tax and had a right to a full refund of **ALL** income tax withheld, **AND**

b ☐ This year I do not expect to owe any Federal income tax and expect to have a right to a full refund of **ALL** income tax withheld. If both a and b apply, enter "EXEMPT" here . . . . ▶

c If you entered "EXEMPT" on line 6b, are you a full-time student? . . . . ☐ Yes ☐ No

Under the penalties of perjury, I certify that I am entitled to the number of withholding allowances claimed on this certificate, or if claiming exemption from withholding, that I am entitled to claim the exempt status.

Employee's signature ▶ Date ▶ , 19

7 Employer's name and address (including ZIP code) (FOR EMPLOYER'S USE ONLY)

8 Office code

9 Employer identification number

------------------------------------ Detach along this line ------------------------------------

▲ *Give the top part of this form to your employer; keep the lower part for your records and information.* ▲

Get Publication 505 from most IRS offices for more information.

Purpose

The law requires that you complete Form W-4 so that your employer can withhold Federal income tax from your pay. Your Form W-4 remains in effect until you change it or, if you entered "EXEMPT" on line 6b above, until February 15 of next year. By correctly completing this form, you can fit the amount of tax withheld from your wages to your tax liability.

Introduction

If you got a large refund last year, you may be having too much tax withheld. If so, you may want to increase the number of your allowances on line 4 by claiming any other allowances you are entitled to. The kinds of allowances, and how to figure them, are explained in detail below.

If you owed a large amount of tax last year, you may not be having enough tax withheld. If so, you can claim fewer allowances on line 4, or ask that an additional amount be withheld on line 5, or both.

If the number of withholding allowances you are entitled to claim decreases to less than you are now claiming, you must file a new W-4 with your employer within 10 days.

The instructions below explain how to fill in Form W-4. **Publication 505** contains more information on withholding. You can get it from most IRS offices.

For more information about who qualifies as your dependent, what deductions you can take, and what tax credits you qualify for, see the Form 1040 Instructions or call any IRS office.

Line-By-Line Instructions

Fill in the identifying information in boxes 1 and 2. If you are married and want tax withheld at the regular rate for married persons, check "Married" in box 3. If you are married and want tax withheld at the higher Single rate (because both you and your spouse work, for example), check the box "Married, but withhold at higher Single rate" in box 3.

Line 4 of Form W-4

Total number of allowances.—Use the worksheet on page 2 to figure your allowances. Add the number of allowances for each category explained below. Enter the total on line 4.

If you are single and hold more than one job, you may not claim the same allowances with more than one employer at the same time. If you are married and both you and your spouse are employed, you may not both claim the same allowances with both of your employers at the same time. To have the highest amount of tax withheld, claim "0" allowances on line 4.

A. Personal allowances.—You can claim the following personal allowances:

1 for yourself, 1 if you are 65 or older, and 1 if you are blind.

If you are married and your spouse either does not work or is not claiming his or her allowances on a separate Form W-4, you may also claim the following allowances: 1 for your spouse, 1 if your spouse is 65 or older, and 1 if your spouse is blind.

B. Special withholding allowance.—Claim the special withholding allowance only if you are single and have one job or you are married, have one job, and your spouse does not work. Use this special withholding allowance only to figure your withholding. Do not claim it when you file your tax return.

C. Allowances for dependents.—You may claim one allowance for each dependent you will be able to claim on your Federal income tax return.

D. Allowances for estimated tax credits.—If you expect to take the credits (such as child care, residential energy, etc.) shown on lines 38 through 46 on the 1981 Form 1040, use the table on the top of page 2 to figure the number of additional allowances you can claim. Include the earned income credit if you are not receiving advance payment of it. Also, if you expect to income average, include the amount of the reduction in tax attributable to averaging when using the table.

E. Allowances for estimated deductions.—If you expect to itemize deductions, you can claim additional withholding allowances. See Schedule A (Form 1040) to find out what deductions you can itemize.

You can also count deductible amounts you pay for (1) alimony (2) qualified retirement contributions (3) moving expenses (4) employee business expenses (Part I of Form 2106) as well as (5) the deduction for two-earner married couples, and (6) net losses shown on Schedules C, D, E, and F (Form 1040). **Note:** Check with your employer to see if any tax is being withheld on moving expenses or IRA contributions the employer is paying. Do not include these amounts if tax is not being withheld; otherwise, you may be underwithheld. For more details see **Publication 505.**

The deduction allowed two-earner married couples is 5% of the lesser of $30,000 or the qualified earned income of the spouse with the lower income. Once you have determined these deductions, enter the total on line E1 of the worksheet on page 2 and figure the number of withholding allowances for them.

Line 5 of Form W-4

Additional amount, if any, you want deducted from each pay.—If you are not having enough tax withheld from your pay, you may ask your employer to withhold more by filling in an additional amount on line 5. Often married couples, both of whom are working, and persons with two or more jobs, need to have additional tax withheld. You may also need to have additional tax withheld because you have income other than wages, such as interest and dividends, capital gains, rents, alimony received, etc. Estimate the amount you will be underwithheld and divide that amount by the number of pay periods in the year. Enter the additional amount you want withheld each pay period on line 5.

For Privacy Act and Paperwork Reduction Act Notice, see back of this page.

Form **W-4** (Rev. 1-82)

BEST COPY AVAILABLE

ASSIGNMENT SHEET #2

Line 6 of Form W-4

Exemption from withholding.—You can claim exemption from withholding only if last year you did not owe any Federal income tax and had a right to a refund of all income tax withheld, and this year you do not expect to owe any Federal income tax and expect to have a right to a refund of all income tax withheld. If you qualify, check boxes 6a and b, write "EXEMPT" on line 6b and answer Yes or No to the question on line 6c.

If you want to claim exemption from withholding next year, you must file a new Form W-4 with your employer on or before February 15 of next year. If you are not having Federal income tax withheld this year, but expect to have a tax liability next year, the law requires you to give your employer a new Form W-4 by December 1 of this year.

If you are covered by the Federal Insurance Contributions Act, your employer must withhold social security tax.

A fine of $500 may be charged if you file a Form W-4 which decreases the tax withheld with no reasonable basis at the time for the decrease. In addition, criminal penalties apply for willfully supplying false or fraudulent information or failing to supply information requiring an increase in withholding.

Your employer must send to IRS any Form W-4 claiming more than 14 withholding allowances or claiming exemption from withholding if the wages are expected to usually exceed $200 a week.

Privacy Act and Paperwork Reduction Act Notice.—If you do not give your employer a certificate, you will be treated as a single person with no withholding allowances as required by Internal Revenue Code sections 3402(l) and 3401(e).

We ask for this information to carry out the Internal Revenue laws of the United States. We may give the information to the Department of Justice for civil or criminal litigation and to the States and the District of Columbia for use in administering their tax laws.

Table for Figuring Your Withholding Allowances For Estimated Tax Credits and Income Averaging

Estimated Salaries and Wages from all Sources	Single Employees		Head of Household Employees		Married Employees (When Spouse not Employed)		Married Employees (When Both Spouses are Employed)	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
Under $10,000	$ 100	$160	$ 20	$160	$ 75	$ 80	$ 105	$ 65
10,000–15,000	140	175	50	175	85	150	295	75
15,001–20,000	155	240	0	240	110	180	410	150
20,001–25,000	160	310	0	310	115	220	605	165
25,001–30,000	165	355	0	355	150	245	885	180
30,001–35,000	260	370	0	370	150	290	1,230	200
35,001–40,000	530	370	0	370	165	330	1,605	225
40,001–45,000	915	370	0	370	280	370	2,175	245
45,001–50,000	1,555	370	365	370	380	370	2,665	245
50,001–55,000	2,205	370	965	370	690	370	3,195	275
55,001–60,000	2,855	370	1,565	370	1,040	370	3,735	280
Over 60,000	4,415	370	3,085	370	2,230	370	5,315	370

Worksheet to Figure Your Withholding Allowances to be Entered on Line 4 of Form W-4

A Personal allowances . . . . ▶ A ______

B Special withholding allowance (not to exceed 1 allowance—see instructions on page 1) . . . . . . ▶ B ______

C Allowances for dependents . . . . ▶ C ______

D Allowances for estimated tax credits and income averaging: (use table above for figuring withholding allowances)

1 Enter estimated tax credits and estimated tax reduction from income averaging . . . . . $______

2 Enter the column (A) amount for your salary range and filing status (single, etc.) . . . . . $______

3 Subtract line 2 from line 1 (If zero or less, do not complete lines 4 and 5) . . . . . . $______

4 Find the column (B) amount for your salary range and filing status . . . . $______

5 Divide line 3 by line 4. Increase any fraction to the next whole number. This is the maximum number of withholding allowances for estimated tax credits and income averaging. Enter here . . . . ▶ D ______

Example: A taxpayer who expects to file a Federal income tax return as a single person estimates annual wages of $12,000 and tax credits of $650. The $12,000 falls in the wage bracket of $10,000 to $15,000. The value in column (A) is 140. Subtracting this from the estimated credits of 650 leaves 510. The value in column (B) is 175. Dividing 510 by 175 gives 2.9. Since any fraction is increased to the next whole number, show 3 on line D.

E Allowances for estimated deductions:

1 Enter the total amount of your estimated itemized deductions, alimony payments, qualified retirement contributions, deduction for two-earner married couples, business losses, moving expenses, and employee business expenses for the year . . . . ▶ 1 $______

2 If you do not plan to itemize deductions, enter $500 on line E2. If you plan to itemize, find your total estimated salaries and wages amount in the left column of the table below. (Include salaries and wages of both spouses.) Read across to the right and enter the amount from the column that applies to you. Enter that amount on line E2 . . . . ▶ 2 $______

Estimated salaries and wages from all sources:	Single and Head of Household Employees (only one job)	Married Employees (one spouse working and one job only)	Employees with more than one job or Married Employees with both spouses working
Under $10,000	$2,800	$3,900	$3,900
10,000–30,000	2,800	3,900	5,600
30,001–40,000	3,300	3,900	7,700
Over $40,000	13% of estimated salaries and wages	10% of estimated salaries and wages	21% of estimated salaries and wages

3 Subtract line E2 from line E1 (But not less than zero) . . . . ▶ 3 $______

4 Divide the amount on line E3 by $1,000 (increase any fraction to the next whole number). Enter here . . ▶ E ______

F Total (add lines A through E). Enter total here and on line 4 of Form W-4 . . . . ▶ F ______

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INDUSTRY ORIENTATION
UNIT III

ASSIGNMENT SHEET #3 — PRACTICE INTERVIEW QUESTIONS

NAME ____ SCORE ________________

An employer may not legally ask questions about an applicant's personal life. In fact, it is illegal for an employer to ask what your maiden name is if you are a female applicant; what your marital status is; who lives with you; what church you attend or who your spiritual leader is; how many children you have, their ages, or who will care for them while you are at work; whether you own or rent your residence; whether you have ever had your wages garnisheed; or whether you have ever been arrested. However, many interviewers, particularly in small businesses, sometimes ask such questions anyway. Whether or not you choose to answer the questions depends on how much you want the job.

The following questions might be asked on an application form or during a job interview. Write an answer for each question. Keep this assignment sheet to review before going to an interview.

A. Why did you leave your previous job?

____

____

B. What did you like best about your job?

____

____

C. Are you in good health?

____

____

D. Do you intend to make this work your career?

____

____

E. What are some of your special abilities?

____

____

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ASSIGNMENT SHEET #3

F. What equipment do you operate?

G. How would you rate your training for this job? Very good? Fair?

H. What personal characteristics do you think are needed to succeed in your vocation?

I. At what salary do you expect to start?

J. How could you contribute to our organization?

K. Why should we hire you?

L. Tell us about your family and any plans for marriage or further education.

(NOTE: REMEMBER — legally, you do not have to answer this question. However, it is a good idea to have an answer prepared.)

ASSIGNMENT SHEET #3

M. Have you applied for any other jobs?

N. Do you have any military obligations to fulfill?

O. Would you be able to work Saturdays and Sundays?

P. Does criticism disturb you?

Q. Would you be willing to relocate?

R. What size city do you prefer?

S. Define *cooperation.*

T. How do you feel about working overtime?

REMEMBER: You never get a second chance to make a good first impression. GETTING A JOB *IS* A JOB!

INDUSTRY ORIENTATION
UNIT III

ASSIGNMENT SHEET #4 — COMPARE JOB OPPORTUNITIES

NAME ______________________________ SCORE ______________

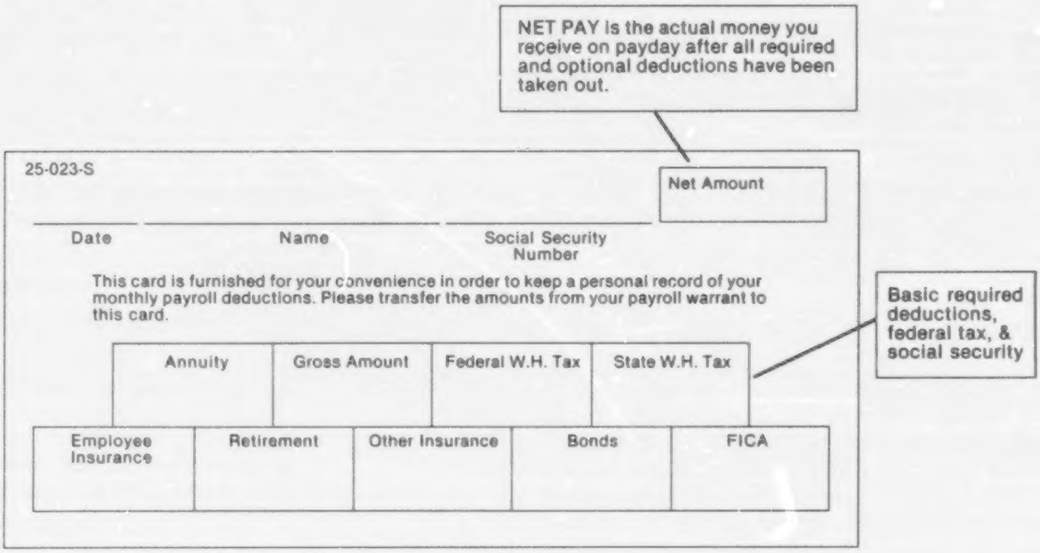
When you are offered a job, there are many factors to weigh before taking the position. Some of these factors include take-home pay, benefits that accompany the job, actual cost of being at work each day, how satisfying the job would be, and how the job would meet your needs and aspirations.

PART I

A. WHAT IS MY TAKE-HOME PAY?

Salaries and wages are often quoted by employers as *gross earnings*. Gross earnings are used because tax deductions vary depending upon the number of dependents, the amount of earnings, and other information.

Optional benefits and deductions offered by an employer also differ. It is generally advisable to ask what programs are available as these can affect the actual money you receive on payday.



NET PAY is the actual money you receive on payday after all required and optional deductions have been taken out.

25-023-S

Net Amount

Date ______ Name ______ Social Security Number ______

This card is furnished for your convenience in order to keep a personal record of your monthly payroll deductions. Please transfer the amounts from your payroll warrant to this card.

Annuity	Gross Amount	Federal W.H. Tax	State W.H. Tax	
Employee Insurance	Retirement	Other Insurance	Bonds	FICA

Basic required deductions, federal tax, & social security

ASSIGNMENT SHEET #4

B. WHAT OTHER BENEFITS DO I GET FROM THE JOB?

Some benefits associated with working are not always visible. Often some of these overlooked benefits are paid for in part by your employer. At the time of the interview or when considering a position, ask about the following benefits:

- Employer's contributions for your protection that may include
  - Health insurance
  - Unemployment compensation
  - Clothing and safety garments
  - Medical facilities and health tests
  - Pensions
  - Travel insurance (covering mishaps when traveling on business)
  - Educational programs or reimbursement for courses related to job
- Sick leave with pay
- Paid vacations and holidays

C. WHAT WILL IT COST TO WORK AT THIS JOB?

We often overlook the costs that are associated with being employed. It may be of value to calculate estimated weekly expenses before you make a decision about a job.

Estimate weekly expenses for

Transportation (gasoline, parking, bus fares) $ _____

Lunches (for cost of food eaten away from home, including soft drinks and coffee) $ _____

Clothing (including cleaning) $ _____

Child care $ _____

Gifts for other employees $ _____

Special uniforms, materials, or equipment for job $ _____

Other $ _____

TOTAL $ _____

ASSIGNMENT SHEET #4

D. WHAT IS IMPORTANT TO ME IN A JOB?

Take-home pay and benefits may be only part of what you want from a job. Think through other things you consider important in a job.

1. What are some of the most rewarding things you have felt about any job you have ever had?

   a. ______________________________

   b. ______________________________

   c. ______________________________

2. How might you rate these in order of what is important to you?

   ______a. Job security (little chance you'll be released from the job)

   ______b. Opportunity for advancement

   ______c. Recognition for your work

   ______d. Good wages

   ______e. Opportunity to learn and use your ideas

   ______f. Flexible working hours

   ______g. Long vacations

   ______h. Pleasant working conditions

   ______i. Interesting work

   ______j. Friendly co-workers

   ______k. Other, such as ______________________________

PART II

Take all the information you have gathered and summarize it below and on the next page to reach a decision about whether you want the job or not.

A. Would the job be satisfying to you? Why/why not?

____

____

____

ASSIGNMENT SHEET #4

B. What are the benefits that accompany the job?

C. How much will it actually cost to be at work each day?

D. How would the job meet your needs and aspirations?

E. I estimate my take-home pay to be $ ______.

F. I estimate my expenses related to working to be $ ______.

G. I estimate my job benefits to be worth $ ______.

H. I would most enjoy the following about this job: ______

INDUSTRY ORIENTATION
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 — Completed to the satisfaction of the instructor

Assignment Sheet #2 — Completed to the satisfaction of the instructor

Assignment Sheet #3 — Completed to the satisfaction of the instructor

Assignment Sheet #4 — Completed to the satisfaction of the instructor

BLC - 99-A

INDUSTRY ORIENTATION
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with industry orientation to their correct definitions. Write the correct numbers in the blanks.

______a. Person employed to perform skills of bricklaying trade

______b. Person or firm that agrees to perform part, or all, of another's contract

______c. Group of related skills within an occupation

______d. Large-scale enterprise relating to crafts and skills of industrial and commercial construction

______e. Ability or proficiency gained by training, practice, or special experience

______f. Skilled activity that is the principal business of one's life

______g. Enterprise dealing with heat-resistant materials such as firebrick for furnaces and fireplaces

______h. Work done in return for pay

1. Trade
2. Refractory industry
3. Skill
4. Job
5. Bricklayer
6. Occupation
7. Construction industry
8. Subcontractor

2. List three facts concerning occupational outlook for bricklayers.

a. ____

____

b. ____

____

c. ____

____

TEST

3. Name five employment opportunities for bricklayers.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

4. Select from the following list guidelines for the bricklaying program. Write an "X" in the blank before each correct answer.

_____a. Ignore instructions and directions

_____b. Be casual about your work

_____c. Exhibit pride in your clothes and tools

_____d. Be responsible

_____e. Be safety conscious and follow safety regulations

_____f. Be sure to take your coffee breaks on time

_____g. Use all tools properly and proficiently

_____h. Borrow tools whenever you can

5. State five characteristics of a good bricklayer.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

6. Name seven major skills involved in bricklaying program.

a. ______________________________

b. ______________________________

TEST

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

(NOTE: Test questions 7 through 10 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

7. Complete employment application.

8. Complete a W-4 form.

9. Practice interview questions.

10. Compare job opportunities.

INDUSTRY ORIENTATION
UNIT III

ANSWERS TO TEST

1.

a.	5	e.	3
b.	8	f.	6
c.	1	g.	2
d.	7	h.	4

2. Answer should include any three of the following

   a. Specialization and new concepts in masonry construction create job opportunities

   b. Increased population creates increased employment opportunities

   c. Construction industry needs more bricklayers each year to build more and larger projects

   d. Mortality and retirement of experienced bricklayers open up employment opportunities

3. Answer should include any five of the following

   a. Independent and union-affiliated residential contractors

   b. Independent and union-affiliated commercial contractors

   c. Prefabrication industry

   d. Refractory industry

   e. Remodeling work

   f. Instructors for training and apprenticeship programs

   g. Restoration of museums, landmarks, and old communities

4. d, e, g

ANSWERS TO TEST

5. Answer should include any five of the following
   a. Checks all equipment before starting work
   b. Operates all power equipment correctly
   c. Is safety conscious and follows safety regulations
   d. Practices conservation of materials and equipment
   e. Takes instructions readily and follows company rules
   f. Displays enthusiasm about job
   g. Exhibits pride in the trade
   h. Is punctual
   i. Is a good citizen
   j. Shows initiative
   k. Cooperates

6. Answer should include any seven of the following
   a. Measuring
   b. Math
   c. Reading construction plans
   d. Layout
   e. Estimating materials
   f. Use of hand tools
   g. Use of power tools and equipment
   h. Construction
   i. Welding and cutting

7. Completed to the satisfaction of the instructor

ANSWERS TO TEST

8. Completed to the satisfaction of the instructor

9. Completed to the satisfaction of the instructor

10. Completed to the satisfaction of the instructor

BECOMING A GOOD LEADER
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to list characteristics of a good leader, and name ways to become a good leader. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Define *leadership*.
2. List characteristics of a good leader.
3. Name benefits of being a good leader.
4. Name ways to become a good leader.
5. Evaluate leadership qualities.
6. Name traits of community leaders.

BECOMING A GOOD LEADER
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Provide students with objective sheet.

   B. Discuss unit and specific objectives.

   C. Provide students with information and assignment sheets.

   D. Discuss information and assignment sheets.

   E. Add to Information Sheet, Section III, any additional benefits of being a good leader.

   F. Remind students that the self-rating personality scale in Assignment Sheet #1 does not need to be handed in nor shared with other students.

   G. Give test.

   H. Complete appropriate section of competency profiles.

   (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment sheets

      1. Assignment Sheet #1 — Evaluate Leadership Qualities

      2. Assignment Sheet #2 — Name Traits of Community Leaders

   E. Answers to assignment sheets

   F. Test

   G. Answers to test

III. Unit references

   A. *Animal Science.* Columbia, Missouri: State Department of Education, Agricultural Education Section, University of Missouri, n.d.

   B. Gray, Jarrell D., and J.R. Jackson. *Leadership Training and Parliamentary Procedure for FFA.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958.

   C. *Official Manual.* Alexandria, Virginia: Future Farmers of America, 1975.

BECOMING A GOOD LEADER
UNIT IV

INFORMATION SHEET

I. Leadership — Combination of qualities that inspires confidence, draws others toward the leader, and causes them to follow

II. Characteristics of a good leader (Assignment Sheets #1 and #2)

  A. Preparedness

  (NOTE: Leadership takes work as well as practice.)

  B. Group-mindedness

  (NOTE: Regard yourself as a part of the group. Say *we* instead of *I*. Do not try to run the group; instead, be guided by the group's wishes.)

  C. Consideration for others

  (NOTE: Be understanding and friendly.)

  D. Poise

  (NOTE: Do not let irritations bother you.)

  E. Humility

  (NOTE: Be confident, but not cocky. Do not be afraid to reveal that you do not know everything.)

  F. Hard work

  (NOTE: Do not ask anyone to do something that you would not be willing to do yourself.)

  G. Responsibility

  (NOTE: Live up to your work and duties.)

  H. Cooperativeness

  (NOTE: Know how to work with others and enjoy working with them.)

  I. Happiness

  (NOTE: Enjoy life—the simple things as well as the big things.)

INFORMATION SHEET

J. Imagination

(NOTE: Help the persons in your group learn and grow through the activities.)

K. Preciseness

(NOTE: Be able to express yourself effectively.)

L. Pride

(NOTE: Take pride in what you do. Take pride in being a leader, but earn it.)

M. Neatness

(NOTE: Always be neat in dress and personal appearance.)

N. Courtesy

(NOTE: The words *please* and *thank you* pay dividends; use them often.)

O. Understanding

(NOTE: Know members' opinions and be ready to meet changing situations.)

P. Ambition

(NOTE: Set goals and make them high, but be sure to reach them.)

Q. Open-mindedness

(NOTE: Take advice, but do your own thinking.)

R. Curiosity

(NOTE: Analyze all the facts before you draw conclusions.)

S. Energy

(NOTE: Do your best at all times. Plan to make the most effective use of your time.)

III. Benefits of being a good leader

A. Self-satisfaction

B. Challenge

INFORMATION SHEET

C. Respect developed for others

D. Maturation

E. Knowledge

F. Pride

G. Security

H. Skills needed in any field

I. Advancement in an occupation

J. Financial betterment

K. Respect of peers

IV. Ways to become a good leader

A. Become a good follower

B. Study qualities of a good leader

C. Evaluate own weak and strong points

D. Develop a plan for training oneself as a leader

BECOMING A GOOD LEADER
UNIT IV

ASSIGNMENT SHEET #1 — EVALUATE LEADERSHIP QUALITIES

NAME ______________________________

A good leader has many positive characteristics. People wanting to develop their leadership skills need to be aware of such positive traits and develop them. This assignment sheet will help you visualize what kind of leader you are.

Circle the appropriate number following each trait. Four is outstanding, three is above average, two is average, one is poor. Total your score on the following page.

(NOTE: This should be completed as a personal evaluation. This assignment sheet should not be handed in to your instructor.)

A.	Do I maintain a well-groomed appearance?	1	2	3	4
B.	Do I have a pleasing voice?	1	2	3	4
C.	Is my posture alert and poised?	1	2	3	4
D.	Is my disposition cheerful?	1	2	3	4
E.	Do I make friends easily?	1	2	3	4
F.	Do I exert a positive leadership?	1	2	3	4
G.	Am I generally thoughtful of the feelings of others?	1	2	3	4
H.	Is my enthusiasm sincere and contagious?	1	2	3	4
I.	Do I persevere until I achieve success?	1	2	3	4
J.	Am I sincere in my interest in other people?	1	2	3	4
K.	Am I ambitious to get ahead?	1	2	3	4
L.	Do I get along well with others?	1	2	3	4
M.	Do I react constructively to criticism?	1	2	3	4
N.	Do I remember names and faces?	1	2	3	4
O.	Am I punctual on all occasions?	1	2	3	4
P.	Do I have and show a spirit of cooperation?	1	2	3	4

ASSIGNMENT SHEET #1

Q.	Am I free from prejudice?	1	2	3	4
R.	Do I know how people react in most situations?	1	2	3	4
S.	Am I generally a good listener?	1	2	3	4
T.	Do I refuse to allow myself to be hurt by what other people say?	1	2	3	4
U.	Can I criticize without being offensive?	1	2	3	4
V.	Do I usually like people for what they are, or do I wait to see if they like me?	1	2	3	4
W.	Do I enjoy being part of a group?	1	2	3	4
X.	Am I reliable?	1	2	3	4
Y.	Can I adapt myself to all situations?	1	2	3	4
Z.	Am I easily discouraged?	1	2	3	4
AA.	Do I apply myself to the problems of each day?	1	2	3	4
BB.	Can I make a decision quickly and accurately?	1	2	3	4
CC.	Am I loyal to my superiors and associates?	1	2	3	4
DD.	Do I try to see the other person's point of view?	1	2	3	4
EE.	Am I neat and clean in my work as well as in my personal appearance?	1	2	3	4
FF.	Do I know where I make my mistakes, and do I admit them?	1	2	3	4
GG.	Am I looking for opportunities to serve others better?	1	2	3	4
HH.	Am I following a systematic plan for improvement and advancement?	1	2	3	4
II.	Can I accept honors and advancements and yet not become conceited?	1	2	3	4
JJ.	Am I playing the game of life honestly and fairly with myself and others with whom I work?	1	2	3	4

TOTAL SCORE ____________

ASSIGNMENT SHEET #1

Evaluation of Assignment Sheet #1

Evaluate your own score — If your score totaled over 100, your personality rating is definitely superior. If you have been honest with yourself, you are among the people who are most likely to succeed. A score of 90 - 100 is above average; 75 - 90 is average; below 75 shows plenty of room for improvement. How did you rate?

BECOMING A GOOD LEADER
UNIT IV

ASSIGNMENT SHEET #2 — NAME TRAITS OF COMMUNITY LEADERS

NAME ______________________________ SCORE ______________

One way to become a good leader is to observe a good role model. Most communities have leaders with excellent leadership qualities.

Select three individuals in your local community who seem to be good leaders. List three leadership traits for each individual.

NAME		LEADERSHIP TRAITS
A. ______________________	1.	______________________
	2.	______________________
	3.	______________________
B. ______________________	1.	______________________
	2.	______________________
	3.	______________________
C. ______________________	1.	______________________
	2.	______________________
	3.	______________________

BECOMING A GOOD LEADER
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 — Completed to the satisfaction of the instructor

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

BLC - 123-A

BECOMING A GOOD LEADER
UNIT IV

TEST

NAME ______________________________ SCORE ____________

1. Define *leadership.*

   ____

2. List five characteristics of a good leader.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

3. Name seven benefits of being a good leader.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

   f. ____

   g. ____

4. Name ways to become a good leader.

   a. ____

   b. ____

   c. ____

   d. ____

TEST

(NOTE: Test questions 5 and 6 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

5. Evaluate leadership qualities.

6. Name traits of community leaders.

BECOMING A GOOD LEADER
UNIT IV

ANSWERS TO TEST

1. Leadership — Combination of qualities that inspires confidence, draws others toward the leader, and causes them to follow

2. Answer should include any five of the following

   a. Preparedness
   b. Group-mindedness
   c. Consideration for others
   d. Poise
   e. Humility
   f. Hard work
   g. Responsibility
   h. Cooperativeness
   i. Happiness
   j. Imagination
   k. Preciseness
   l. Pride
   m. Neatness
   n. Courtesy
   o. Understanding
   p. Ambition
   q. Open-mindedness
   r. Curiosity
   s. Energy

3. Answer should include any seven of the following

   a. Self-satisfaction
   b. Challenge
   c. Respect developed for others
   d. Maturation
   e. Knowledge
   f. Pride
   g. Security
   h. Skills needed in any field

ANSWERS TO TEST

   i. Advancement in an occupation
   j. Financial betterment
   k. Respect of peers

4. Answer should include the following
   a. Become a good follower
   b. Study qualities of a good leader
   c. Evaluate own weak and strong points
   d. Develop a plan for training oneself as a leader

5. Completed to the satisfaction of the instructor

6. Evaluated to the satisfaction of the instructor

JOB ADVANCEMENT
UNIT V

UNIT OBJECTIVE

After completing this unit, the student should be able to list characteristics employers consider when deciding whom to promote. The student should also be able to name sources of additional education and training and be able to develop a program for self-improvement. The student will show this knowledge by completing the assignment sheet and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with job advancement to their correct definitions.
2. List characteristics employers consider in deciding whom to promote.
3. Select from a list ways good attitudes show on the job.
4. Discuss steps that will help in job advancement.
5. Select from a list benefits of additional education and training.
6. Name sources of additional education and training.
7. Discuss activities and/or commitments that will help prepare a person for advancement and responsibility.
8. Develop a program for self-improvement.

JOB ADVANCEMENT
UNIT V

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Provide students with objective sheet.

   B. Discuss unit and specific objectives.

   C. Provide students with information and assignment sheets.

   D. Discuss information and assignment sheets.

   E. Invite a personnel officer to speak to the class about human relations.

   F. Give test.

   G. Complete appropriate section of competency profiles.

   (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment Sheet #1 — Develop a Program for Self-Improvement

   E. Answers to assignment sheet

   F. Test

   G. Answers to test

III. Unit references

   A. Agnew, Peter L., James R. Meehan, and William R. Pasewark. *Clerical Office Practice,* 4th ed. Cincinnati: South-Western Publishing Co., 1967.

   B. Frakes, John C., Fred Archer, and Raymond Breckner. *General Office Practice,* 2nd ed. Dallas: Gregg Division/McGraw-Hill Book Co., 1966.

   C. Kimbrell, Grady, and Ben S. Vineyard. *Succeeding in the World of Work.* Bloomington, Illinois: McKnight and McKnight Publishing Co., 1970.

SUGGESTED ACTIVITIES

D. Whitcomb, Helen, and R. Lang. *Charm.* Dallas: Gregg Division/McGraw-Hill Book Co., 1964.

E. *You and Your Job: How to Keep It.* Chicago: J.G. Ferguson Publishing Co., 1968.

F. *You and Your Job: Where Do You Go from Here?* Chicago: J.G. Ferguson Publishing Co., 1968.

JOB ADVANCEMENT
UNIT V

INFORMATION SHEET

I. Terms and definitions

   A. Adaptability — Ability to adjust easily to new situations

   B. Cooperativeness — Ability to work with others toward a desired goal

   C. Goodwill — Feeling of rapport and respect that has been established between individuals

   D. Initiative — Act of a self-starter; finding things that need to be done without having to be told

   E. Perseverance — Following a job through to its completion

   F. Seniority — Status according to length of continuous service

II. Characteristics employers consider in deciding whom to promote

   (NOTE: These are not listed in order of importance.)

   A. Attitude

   B. Seniority

   C. Quality of work

   D. Quantity of work

   E. Initiative

   F. Perseverance

   G. Cooperativeness

   H. Adaptability

   I. Ability to think

   J. Adequacy of training

III. Ways good attitudes show on the job

   A. Punctuality

   B. Dependability

INFORMATION SHEET

C. Sincerity

D. Loyalty

E. Quality work

F. Quantity work

G. Pride in job

H. Cooperativeness

I. Aggressiveness

J. Personal organization

IV. Steps that will help in job advancement

A. Master present job completely

1. Follow directions
2. Ask questions when unsure
3. Follow standard practices
4. Meet deadlines
5. Keep standards high
6. Check quality of work

B. Develop a program for self-improvement (Assignment Sheet #1)

1. Improve personality
2. Increase skills
3. Continue education

C. Show initiative on the job

1. Take on additional responsibilities
2. Handle more complicated work

INFORMATION SHEET

3. Suggest improvements

   (NOTE: Do not be overly ambitious at the expense of a more qualified person.)

V. Benefits of additional education and training

   A. Advancement and job stability

   B. Better pay

   C. More exciting and challenging position

   D. Increased responsibilities

   E. Prestige

   F. Personal satisfaction

VI. Sources of additional education and training

   A. Postsecondary courses or classes

   B. Specialized courses

   C. Seminars and workshops for advanced training

   D. Colleges, junior colleges, and universities

   E. Adult education centers

   F. Local, state, and national conventions

VII. Activities and/or commitments that will help prepare a person for advancement and responsibility

   A. Reading

      1. Improving general knowledge

      2. Improving communication

      3. Enlarging areas of interest

      4. Keeping up-to-date in the field

   B. Joining professional organizations

   C. Being active in civic and community projects

JOB ADVANCEMENT
UNIT V

ASSIGNMENT SHEET #1 — DEVELOP A PROGRAM FOR SELF-IMPROVEMENT

NAME ______________________________ SCORE ______________

Professional workers cannot afford to discontinue their educational pursuits after high school graduation. They must constantly be working to improve their own personalities and skills. Professional workers have the responsibility to keep abreast in the field so that they will be able to suggest ways to reduce costs, increase efficiency, and stimulate profits. Good workers must also develop plans for self-improvement.

Hints for setting up a plan:

Select only a few items to work on at first; add additional items later as your schedule permits.

Set aside a certain time of the week for study and improvement. Do not be tempted to skip your improvement sessions.

Keep your plans simple enough that they do not interfere with your job by making you tired and sluggish.

Visit the public library often to review new books and periodicals.

Compare notes with friends who are working on similar plans.

Check into courses offered at local schools or universities.

Try to learn from others.

Finish each program that you start.

A. Complete the following questions.

1. In what personal areas are you weak? Grooming? Voice? Personality? List those areas in which you need improvement.

____

____

____

2. What skills do you have that need improvement? List them below.

____

____

____

ASSIGNMENT SHEET #1

3. Do you consistently try to improve your skills?____________________

4. Do you do additional reading in those areas in which you are interested?

____

5. How many hours do you spend watching television per week (approximately)?

____

6. Could you devote one-third of this time to self-improvement?____________

B. Make your plan for self-improvement.

1. Record, on a separate sheet of paper, how you spend your time each day for a week.

2. Review the way you spend your time.

3. List the specific hours you plan to spend during the week for self-improvement.

____

____

____

4. List three immediate goals you hope to achieve.

   a. ____________________________________

   b. ____________________________________

   c. ____________________________________

5. Outline your self-improvement plan for the next month, using the space below.

____

____

____

____

____

____

ASSIGNMENT SHEET #1

6. After one month of working on your individual improvement plan, review the results. What have you achieved? What had you hoped to achieve that you did not?

7. List the times you let something else take precedence over your self-improvement program.

JOB ADVANCEMENT
UNIT V

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1 — Completed to the satisfaction of the instructor

JOB ADVANCEMENT
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with job advancement to their correct definitions. Write the correct numbers in the blanks.

_____a. Act of a self-starter; finding things that need to be done without having to be told

_____b. Ability to work with others toward a desired goal

_____c. Feeling of rapport and respect that has been established between individuals

_____d. Following a job through to its completion

_____e. Status according to length of continuous service

_____f. Ability to adjust easily to new situations

1. Adaptability
2. Cooperativeness
3. Goodwill
4. Initiative
5. Perseverance
6. Seniority

2. List five characteristics employers consider in deciding whom to promote.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

3. Select from the following list ways good attitudes show on the job. Write an "X" in the blank before each correct answer.

_____a. Punctuality

_____b. Loafing

_____c. Gossip

_____d. Dependability

TEST

______e. Sincerity

______f. Doing sloppy work

______g. Loyalty

______h. Using company time for personal activities

______i. Pride in job

______j. Aggressiveness

______k. Personal organization

______l. Being late for work

______m. Cooperativeness

4. Discuss steps that will help in job advancement.

   a. Master present job completely — ________________________________

   ____

   ____

   ____

   ____

   ____

   ____

   b. Develop a program for self-improvement — ________________________

   ____

   ____

   ____

   c. Show initiative on the job — ______________________________

   ____

   ____

   ____

TEST

5. Select from the following list benefits of additional education and training. Write an "X" in the blank before each correct answer.

   _____a. Better pay

   _____b. College degree

   _____c. Prestige

   _____d. Advancement and job stability

   _____e. Personal satisfaction

   _____f. Increased responsibilities

   _____g. Less exciting and challenging position

6. Name four sources of additional education and training.

   a. ____

   b. ____

   c. ____

   d. ____

7. Discuss activities and/or commitments that will help prepare a person for advancement and responsibility.

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

(NOTE: Test question 8 lists the assignment sheet. It is an important part of this test. If it has not been completed, check with your instructor.)

8. Develop a program for self-improvement.

JOB ADVANCEMENT
UNIT V

ANSWERS TO TEST

1.

a.	4	d.	5
b.	2	e.	6
c.	3	f.	1

2. Answer should include any five of the following
    a. Attitude
    b. Seniority
    c. Quality of work
    d. Quantity of work
    e. Initiative
    f. Perseverance
    g. Cooperativeness
    h. Adaptability
    i. Ability to think
    j. Adequacy of training

3. a, d, e, g, i, j, k, m

4. Discussion should include the following
    a. Master present job completely
        1) Follow directions
        2) Ask questions when unsure
        3) Follow standard practices
        4) Meet deadlines

ANSWERS TO TEST

5) Keep standards high

6) Check quality of work

b. Develop a program for self-improvement

1) Improve personality

2) Increase skills

3) Continue education

c. Show initiative on the job

1) Take on additional responsibilities

2) Handle more complicated work

3) Suggest improvements

5. a, c, d, e, f

6. Answer should include any four of the following

a. Postsecondary courses or classes

b. Specialized courses

c. Seminars and workshops for advanced training

d. Colleges, junior colleges, and universities

e. Adult education centers

f. Local, state, and national conventions

7. Discussion should include the following

a. Reading

1) Improving general knowledge

2) Improving communication

3) Enlarging areas of interest

4) Keeping up-to-date in the field

ANSWERS TO TEST

b. Joining professional organizations

c. Being active in civic and community projects

8. Completed to the satisfaction of the instructor

SAFETY AND FIRST AID
UNIT VI

UNIT OBJECTIVE

After completing this unit, the student should be able to practice personal safety and job safety while performing duties and be able to perform first-aid treatment for accident victims. The student will show this knowledge by completing assignment sheets, job sheets, and unit test with a miminum score of 100 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with safety and first aid to their correct definitions.
2. State personal safety rules.
3. State job safety rules.
4. State reasons for practicing job safety.
5. Match colors of the safety color code to their correct applications.
6. Select from a list components of the fire triangle.
7. Match classes of fires to their correct descriptions.
8. Match types of fire extinguishers to the class of fire for which each is used.
9. List in correct order procedures used to lift heavy objects correctly.
10. State safety rules concerning flammable liquids.
11. Name reasons why knowledge of first aid is important.
12. Discuss reasons why first-aid skills are needed.
13. Arrange in order immediate steps to follow when giving first aid to an accident victim.
14. Select from a list factors to consider in first-aid treatment of shock.
15. Classify burns by degree according to their descriptions.
16. Match first-, second-, and third-degree burns to their correct first-aid treatments.
17. Describe first-aid steps to follow to control bleeding by direct pressure.

OBJECTIVE SHEET

18. Arrange in order steps to follow for mouth-to-mouth resuscitation.
19. State measures to take for prevention of heat stroke, heat cramps, and heat exhaustion.
20. Write critical information about symptoms and treatment of heat stroke, heat cramps, and heat exhaustion.
21. Complete a safety pledge form.
22. Analyze accident case studies.
23. Identify good and bad personal safety practices.
24. Demonstrate the ability to
    a. Give mouth-to-mouth resuscitation.
    b. Show proper way to lift a heavy object.

SAFETY AND FIRST AID
UNIT VI

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order films to supplement unit.

1. *Housekeeping Means Safekeeping.* Color, 10 minutes, Journal Films, Inc., 1975. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

2. *Stop a Fire Before It Starts.* Color, 10 minutes, Journal Films, Inc., 1975. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

3. *A New Way to Lift.* Color, 9 minutes, Journal Films, Inc., 1970. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

4. *It Always Happens to the Other Guy.* Color, 21 minutes, Modern Talking Picture Service, 1980. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.

5. *The Industrial Weight Lifter.* Color, 12 minutes, Ruddel Films for Industrial Accident Prevention Association, Ontario and Canada Packers, Ltd., 1965. Available from International Film Bureau, Inc., 332 South Michigan Avenue, Chicago, Illinois 60604.

B. Obtain transparencies.

(NOTE: Transparencies are available from AGC and CIMC.)

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information, assignment, and job sheets.

F. Discuss information and assignment sheets.

G. Gather equipment and materials for job sheet demonstrations.

H. Demonstrate and discuss procedures outlined in job sheets.

I. Invite a safety engineer to speak to the class concerning safety on the job.

J. Show color samples and conduct an oral drill on the colors and applications of the safety color code.

SUGGESTED ACTIVITIES

K. Have students operate a fire extinguisher.

L. Have students complete a first-aid course and earn certification according to OSHA regulations.

M. Have students demonstrate ability to practice safety and first aid in accordance with the *Eight-Hour First-Aid and Safety Standards* set up by MSHA and OSHA.

N. Give test.

O. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM #1 — The Fire Triangle
2. TM #2 — Types of Fire Extinguishers
3. TM #3 — Correct Way to Lift Heavy Objects
4. TM #4 — Face and Skin Conditions in Heat Stroke and Heat Exhaustion

E. Assignment sheets

1. Assignment Sheet #1 — Complete a Safety Pledge Form
2. Assignment Sheet #2 — Distinguish Among Symptoms and Treatments for Heat Stroke, Heat Cramps, and Heat Exhaustion
3. Assignment Sheet #3 — Analyze Accident Case Studies
4. Assignment Sheet #4 — Identify Good and Bad Personal Safety Practices

F. Answers to assignment sheets

SUGGESTED ACTIVITIES

G. Job sheets

  1. Job Sheet #1 — Give Mouth-to-Mouth Resuscitation

  2. Job Sheet #2 — Show Proper Way to Lift a Heavy Object

H. Test

I. Answers to test

III. Unit references

A. *An Accident Prevention Program for School, Shops, and Laboratories.* Washington, D.C.: U. S. Department of Health, Education, and Welfare, Office of Education, Department of Vocational Education/Pennsylvania State University, 1971.

B. Associated General Contractors of America. *Manual of Accident Prevention in Construction.* Washington D.C.: 1971.

C. *Federal Register.* Department of Labor, Vol. 36, No. 105, pt. 2. Washington, D.C.: 29 May, 1971.

D. *First Aid.* United States Department of Labor, Bureau of Mines. Washington, D.C.: 1978.

E. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator Instructional Materials,* Vol. 1. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1981.

F. National Safety Council. *Accident Prevention Manual for Industrial Operations,* 7th ed. Chicago, Illinois: 1974.

G. *Rubber-Tired Front End Loader and Forklift Truck Accident Prevention.* United States Department of the Interior, Mining Enforcement and Safety Administration, Mesa Instruction Guide 30. Washington, D.C.: 1975.

H. *Safety Practices and Procedures in School Shops.* Department of Education/Division of Vocational Education, State Department of Vocational Education. Trenton, New Jersey: n.d.

I. Smith, Earl. *Power Line Technician.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1978.

SAFETY AND FIRST AID
UNIT VI

INFORMATION SHEET

I. Terms and definitions

   A. Accident — Any suddenly occurring, unintentional event that causes injury or property damage

   B. Carelessness — Condition of being unsafe

   (NOTE: Carelessness is the major cause of accidents.)

   C. Combustible — Capable of bursting into flame

   D. Explosive — Tending to explode

   E. Extinguish — To cause to cease burning

   F. First aid — Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

   G. Flammable — Capable of being easily ignited and burning with extreme rapidity

   H. Hazard — Source of danger

   I. Hemorrhage — Heavy loss of blood

   J. MSHA — Mine Safety and Health Administration

   K. OSHA — Occupational Safety and Health Act; federal legislation designed to ensure safe and sanitary working conditions for employees

   L. Pneumatic — Air-powered

   M. Pressurized — Stored under pressure greater than the pressure of the atmosphere

   N. Radiation — Combined process of emission, transmission, and absorption of radiant energy

   O. Resuscitation — Act of bringing one back to full consciousness

   P. Safety — State or condition of being safe; freedom from danger, risk, or injury

   Q. Shock — Depressed condition of many of the body functions due to failure of enough blood to circulate through the body following serious injury

   R. Solvent — Liquid substance capable of dissolving or dispersing one or more other substances

INFORMATION SHEET

S. Tourniquet — Device such as a bandage and stick used to check bleeding or blood flow

(CAUTION: A tourniquet should be used only for severe, life-threatening hemorrhage that cannot be controlled by other means.)

II. Personal safety rules (Assignment Sheets #1 and #4)

A. Wear close-fitting clothing appropriate for the activity being performed

B. Confine long hair before operating equipment

C. Wear safety glasses, suitable hard hat, goggles, safety shoes, gloves, and respiratory equipment where required

D. Remove ties and fasten loose sleeves when working around machine tools or rotating equipment

E. Remove rings and other jewelry when working

F. Use soap and water frequently as a method of preventing skin disease

G. Be familiar with location of fire-fighting equipment and first-aid equipment

H. Be alert, and conduct yourself in a manner that will ensure safe practices

I. Do not carry hand tools in pockets

III. Job safety rules (Assignment Sheet #3)

A. Keep all tools sharp, clean, and in safe working order

B. Retain guards and safety devices on all equipment

C. Report defective tools, machines, or other equipment to the supervisor

D. Report all accidents to the supervisor, regardless of nature or severity

E. Be sure that machine and equipment operators turn off power and do not leave until equipment has stopped

F. Operate a hazardous machine *only after* receiving instructions on how to operate the machine safely

G. Disconnect power from machine tools before performing service or maintenance on machine

INFORMATION SHEET

H. Clean up any spilled liquids immediately

I. Use a solvent only after determining its properties, the kind of work it is formulated to do, and how to use it

J. Use correct, properly fitting wrenches on nuts and bolts

K. Keep work area clear of scraps and litter

L. Clean chips from saws and grinders with a brush, not with your hands or a rag; *do not* clean while machine is running

M. Do not use compressed air to clean yourself or your clothing

N. Use only approved scaffolding

O. Use a swing scaffold only after proper instructions and in accordance with OSHA regulations

P. Be conscious of others' safety

Q. Obey all safety rules, and observe limitations on equipment according to specifications and manufacturer's regulations

R. Never operate equipment or part of equipment within 20 feet of any electrical power line or power source or as specified by local safety codes or regulations

(NOTE: If operating near power lines, power should be cut off or lines should be insulated.)

IV. Reasons for practicing job safety

A. Preventing physical harm to yourself and others

B. Avoiding loss of work

C. Avoiding possible loss of pay

D. Lowering cost to employer

E. Preventing loss of or damage to equipment and/or materials

F. Lowering insurance rates

G. Preventing hardship on family

H. Providing regular job schedules

INFORMATION SHEET

I. Preventing possible loss of job

V. Colors and applications of the safety color code

A. Federal safety red

1. Designates danger
2. Identifies fire protection equipment and its location
3. Identifies portable containers of flammable liquids
4. Identifies emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

B. Federal safety yellow

1. Designates caution and marks physical hazards
2. Designates waste containers for explosive or combustible materials
3. Designates caution against starting, using, or moving equipment while under repair, or against the use of defective equipment
4. Identifies the starting point or power source of machinery

C. Federal safety orange

1. Designates dangerous parts of equipment that may cut, crush, shock, or otherwise injure
2. Designates safety starter buttons and parts of equipment that may cause electrical shock
3. Designates exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws

D. Federal safety purple — Designates radiation hazards

E. Federal safety green

1. Designates location of safety equipment
2. Designates location of first-aid equipment

   (NOTE: This color applies to equipment other than fire-fighting equipment.)

F. Federal safety black and white (used individually or in combination)

INFORMATION SHEET

1. Designates traffic flow

2. Designates housekeeping purposes

3. Designates storage areas

VI. Components of the fire triangle (Transparency #1)

(NOTE: To produce fire, the following three elements are necessary and must be present at the same time. If any one of the three is missing, a fire cannot be started. With the removal of any one of the three, the fire will be extinguished.)

A. Fuel

(NOTE: Fuel may be any flammable material.)

B. Heat

(NOTE: Enough heat must be present to raise the fuel to its ignition temperature.)

C. Oxygen

(NOTE: Oxygen is necessary to sustain combustion.)

VII. Descriptions of classes of fires

A. Class A — Fires that occur in ordinary combustible material such as wood, rags, and rubbish

B. Class B — Fires that occur with flammable liquids such as gasoline, oil, grease, paint, and thinners

C. Class C — Fires that occur in or near electrical equipment such as motors, switchboards, and electrical wiring

(CAUTION: Never use pressurized water on a Class C fire.)

D. Class D — Fires that occur with combustible metals such as iron or magnesium

INFORMATION SHEET

VIII. Types of fire extinguishers used on classes of fires (Transparency #2)

(NOTE: On Class D fires, dry sand is as effective as any dry chemical.)

A. Pressurized water — Used on Class A fires *only*

B. Carbon dioxide (CO_2) — Used on Class B and C fires

C. Multipurpose dry chemical — Used on Class A, B, and C fires

D. Dry powder — Used on Class D fires

E. Water pump tank — Used on Class A fires *only*

F. Foam — Used on Class B fires *only*

IX. Correct procedures for lifting heavy objects (Transparency #3)

A. Step up to object with feet apart; place one foot beside object and one behind

B. Lift with legs, not with back

C. Keep back straight, nearly vertical

D. Tuck chin in

E. Grasp object with whole hand

F. Tuck elbows and arms in

G. Hold load close to body

H. Keep body weight directly over feet

I. Lift object

(NOTE: Know your own physical capabilities and limits; *do not* lift heavy objects without help.)

X. Safety rules concerning flammable liquids

A. Know location and use of fire extinguishers for flammable liquids

B. Store all flammable liquids in approved safety containers

C. Do not operate an engine that is leaking gasoline

D. Change oil- or gasoline-soaked clothing immediately

INFORMATION SHEET

E. Do not fuel a running gasoline engine

XI. Reasons why knowledge of first aid is important

A. May mean the difference between life and death

B. May mean the difference between temporary or permanent injuries

C. Teaches one what to do and what not to do in an emergency

XII. Reasons why first-aid skills are needed

A. Accidents are the number one cause of death

B. There may not be time to wait for professional medical help after an accident

C. Safety awareness needs to be promoted on the job

XIII. Immediate steps to follow when giving first aid to an accident victim

(NOTE: These steps are important not only because they may help the victim but also because the information learned must be reported accurately when you call for professional medical help.)

A. Observe overall emergency

(NOTE: Find out exactly what happened as quickly as possible because this will prepare you for examining the victim and determining what to do first.)

B. Check breathing

(NOTE: Check by laying your hand on victim's chest and holding your ear to victim's nose and mouth.)

C. Check pulse or heartbeat

(NOTE: Pulse in wrist may be reduced, so check pulse in neck or groin.)

D. Observe pupil reactions of the eyes (Figure 1)

(NOTE: Pupils may be constricted or dilated.)

EXAMPLE:

FIGURE 1

Constricted

Dilated

INFORMATION SHEET

E. If victim is conscious, check alertness level by asking questions about victim's physical status

F. Begin definite first-aid treatment for symptoms

(NOTE: If you are not sure of symptoms and/or cause of emergency, do not move the victim. Keep victim quiet and warm, and do not give victim anything to drink or eat.)

XIV. First-aid treatment of shock

(NOTE: Shock may be caused by the loss of any body fluid resulting from prolonged conditions, severe injuries, infection, heart attack or stroke, poisoning, or lack of oxygen. Shock may also be caused by metabolic disorders such as diabetes.)

A. Keep victim lying down

B. Maintain adequate supply of oxygen

C. Cover victim to prevent loss of body heat and to stabilize blood circulation

D. Use good judgment in giving fluids; consider the victim's condition and the cause of shock

(NOTE: Give only a few sips of fluid at a time, and give no alcoholic beverages. If there is a danger of victim's choking or vomiting, do not give any fluids.)

E. Get medical help as soon as possible

XV. Descriptions of types of burns

A. First-degree burns

(NOTE: First-degree burns can be caused by sunburn, light contact with hot objects [accidentally touching a hot engine component], or contact with hot water or scalding steam [radiator].)

1. Redness or discoloration
2. Mild swelling and pain
3. Rapid healing

INFORMATION SHEET

B. Second-degree burns

(NOTE: Second-degree burns can be caused by contact with hot liquids [hot tar or asphalt] or by a deep sunburn.)

1. Pain greater than first degree
2. Damage extending into the first layer of tissue
3. Mottled or red areas
4. Blistering
5. Considerable swelling
6. Wet appearance of burned area due to loss of plasma

C. Third-degree burns

(NOTE: Third-degree burns can be caused by contact with flame, contact with hot objects, acid, electricity, or immersion in hot water.)

1. Deep tissue destruction
2. Less pain due to nerve destruction

   (NOTE: Pain may be greatly diminished because nerve tissue has been burned.)

3. Charred or white appearance of burned area

XVI. First-aid treatment of first-, second-, and third-degree burns

(NOTE: When assessing burns to determine treatment, look at the percentage of the body burned and the areas injured.)

A. First degree — Apply cold water, or submerge burned area in cold water; apply a dry dressing if necessary

B. Second degree — Submerge the part in cold water (not ice water) until pain eases; blot dry gently and apply dry, sterile dressings; do not break blisters, and do not use any ointments, sprays, or home remedies on burned area

C. Third degree — Cover burns with thick sterile dressings, but do not immerse in water; do not remove any tissue or burned clothing; transport victim to hospital as quickly as possible

INFORMATION SHEET

XVII. First-aid steps to follow to control bleeding by direct pressure

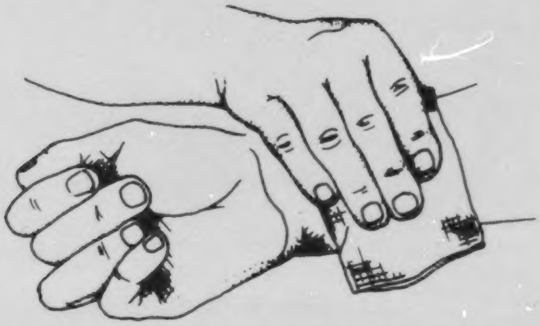
(NOTE: A victim may suffer shock and loss of consciousness from loss of blood. Because it is possible to bleed to death in a very short period of time, bleeding should be brought under control as soon as possible.)

A. Apply dressing (prepared gauze, clean handkerchief, clean articles of clothing) to area, using firm pressure with hand (Figure 2)

(NOTE: In some cases the bare hand has to be used until a suitable dressing or compress can be found.)

EXAMPLE:

FIGURE 2

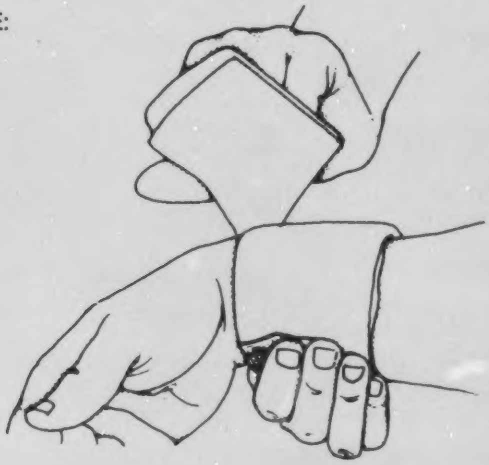


B. Check frequently to see if bleeding has stopped or slowed (Figure 3)

(CAUTION: Do not disturb clots after they have formed. If blood soaks through cloth, do not remove, but add more layers of dressing.)

EXAMPLE:

FIGURE 3



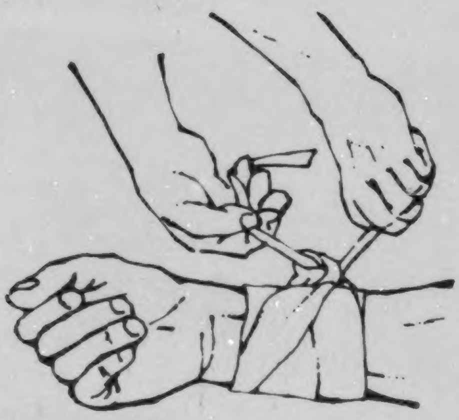
INFORMATION SHEET

C. If bleeding is still active, apply a pressure bandage by holding the dressing in place with one hand, wrapping bandage directly over and around the injured area, and tying the knot over the wounded area (Figure 4)

(NOTE: Use firm motion, but do not wrap too tightly or circulation will be impaired.)

EXAMPLE:

FIGURE 4

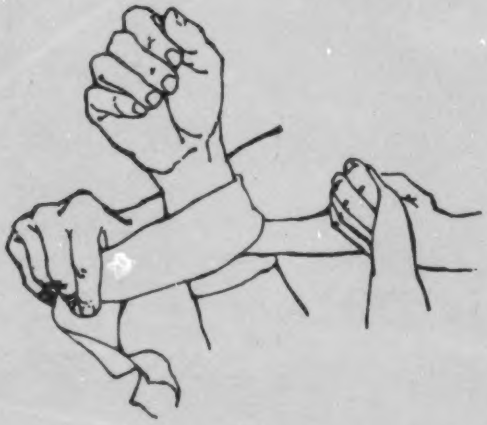


D. If injury is to a limb, elevate limb, if possible, above the level of the victim's heart (Figure 5)

(NOTE: Limb should be elevated only if no apparent fracture has occurred in injured limb.)

EXAMPLE:

FIGURE 5



INFORMATION SHEET

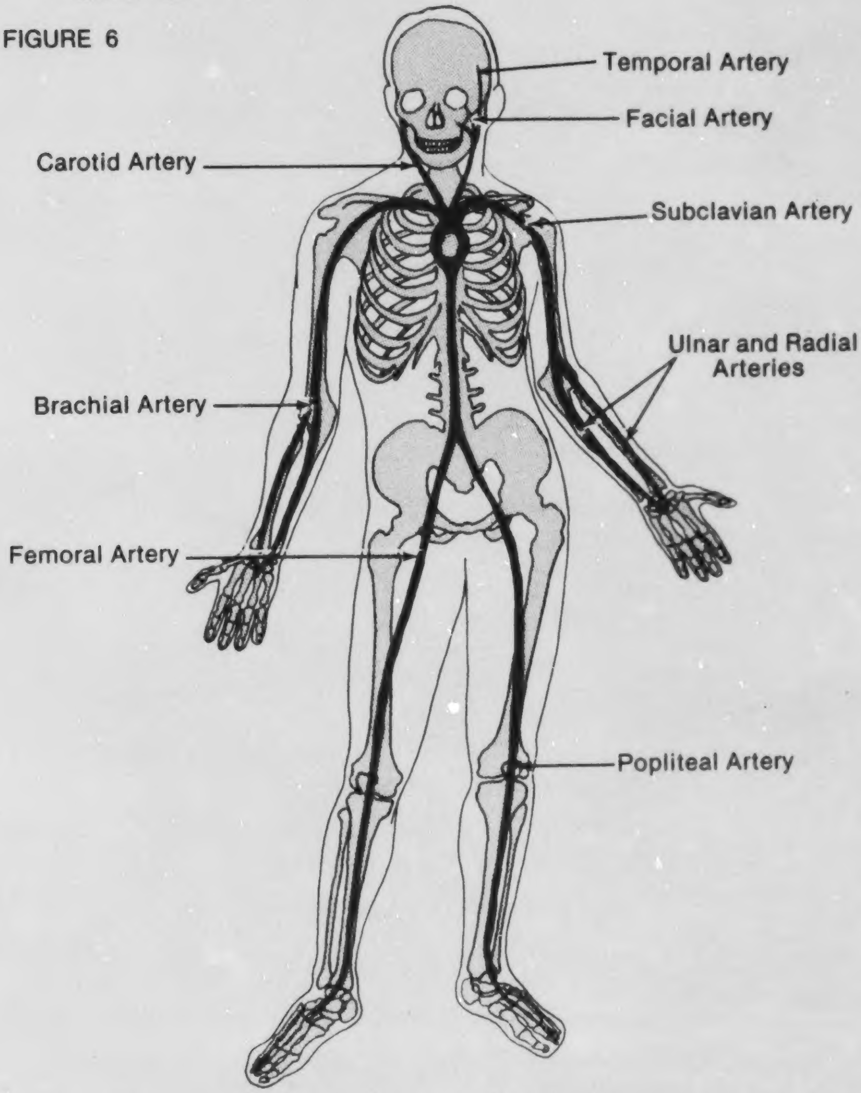
E. If bleeding continues, apply pressure on the main artery that supplies blood to the injured area

(CAUTION: Apply a tourniquet ONLY AS A LAST RESORT. A tourniquet may be necessary to save the victim's life, but remember that a tourniquet cuts off circulation and may cost the victim his or her limb. If you must use a tourniquet, MAKE SURE that the victim is seen by a physician as soon as possible.)

(NOTE: Refer to the following diagram [Figure 6] for pressure points to control bleeding in various areas.)

EXAMPLE:

FIGURE 6


Temporal Artery
Facial Artery
Carotid Artery
Subclavian Artery
Ulnar and Radial Arteries
Brachial Artery
Femoral Artery
Popliteal Artery

INFORMATION SHEET

XVIII. Steps to follow for mouth-to-mouth resuscitation

(CAUTION: Never give mouth-to-mouth resuscitation to a breathing person.)

A. Clear victim's air passage

B. Remove all foreign objects from victim's mouth and throat

C. Extend victim's chin by lifting up under neck

D. Pinch victim's nostrils shut

E. Inhale deeply, and while making an airtight seal with your mouth over the victim's mouth, breathe into victim's mouth until chest rises

F. Remove your mouth from victim's mouth, and listen for return flow of air

(NOTE: Continue this procedure at a rate of one breath per five seconds, or twelve breaths per minute [for an adult], until the victim is revived or until it is no longer necessary.)

XIX. Measures for prevention of heat stroke, heat cramps, and heat exhaustion

A. Drink plenty of fluids

B. Increase salt intake

(NOTE: Electrolyte solutions provide a palatable method of taking salt, potassium, glucose, and ascorbic acid to combat heat fatigue and prevent an electrolyte imbalance from occurring.)

C. Do not overexert

D. Wear lightweight clothing

E. Keep head covered and face shaded

F. Take frequent, short work breaks

G. Rest in shade whenever possible

INFORMATION SHEET

XX. Heat stroke, heat cramps, and heat exhaustion (Transparency #4; Assignment Sheet #2)

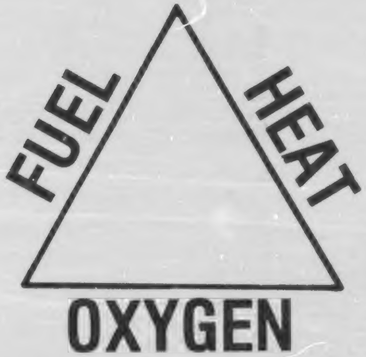
Condition	Symptoms	Treatment
Heat Stroke (NOTE: Heat stroke is an immediate, life-threatening emergency urgently requiring medical attention.)	Visual disturbances Headache Nausea *High* body temperature (NOTE: Body temperature may be as high as 106°F.) Hot, flushed, *dry* skin Strong, rapid pulse Slow, deep breathing Offensive body odor Possible convulsions Possible loss of consciousness	Cool the body immediately (NOTE: Once temperature is reduced to 102°F, guard against overchilling.) Remove clothing, and sponge body with cool (not cold) water or rubbing alcohol Use fans, air-conditioners, or fan by hand to circulate air and promote cooling Provide continuous massage toward the heart Give artificial respiration if needed Transport to medical care as soon as possible Do not give stimulants or alcohol EXAMPLES: Colas, beer, coffee, tea
Heat Cramps (NOTE: Heat cramps may precede an attack of heat exhaustion.)	Abdominal pain Nausea Dizziness Pale skin Heavy sweating Muscular twitching Severe muscle cramps	Get victim to a cool place Exert firm pressure with your hands on the cramped muscles, or gently massage them Give *sips* of salt water EXAMPLE: Give 1/4 teaspoon of salt per glass of water (1 teaspoon per quart) every fifteen minutes for an hour. Do not give plain (unsalted) cold drinks Do not give stimulants or alcohol EXAMPLES: Colas, beer, coffee, tea

INFORMATION SHEET

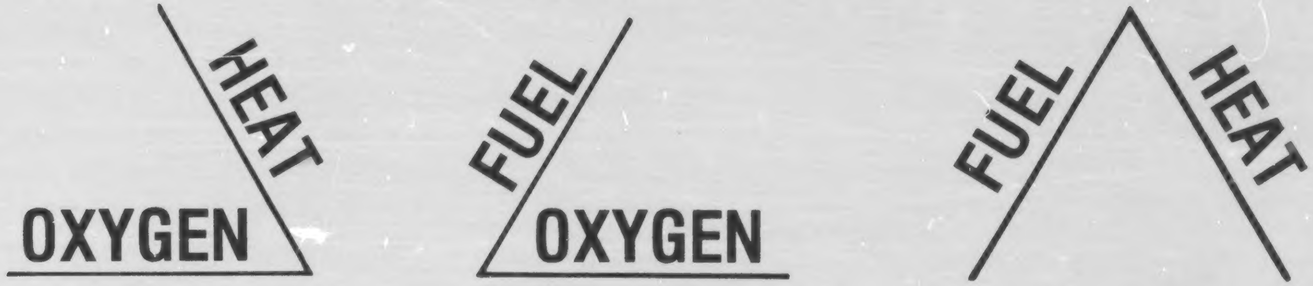
Condition	Symptoms	Treatment
Heat Exhaustion	Approximately normal body temperature Pale, clammy skin Heavy sweating Nausea Possible vomiting Weakness, tiredness Fast, weak pulse Possible loss of consciousness (NOTE: Victim will probably regain consciousness as head is lowered.)	(NOTE: Recovery is usually complete, with proper care.) Move victim out of the sun, preferably to an air-conditioned room Loosen clothing Fan Apply cool, wet cloths Give *sips* of salt water EXAMPLE: Give ¼ teaspoon per glass of water (1 teaspoon per quart) every fifteen minutes for an hour Allow fluids as desired if victim is able to swallow (NOTE: If victim is vomiting, get him or her to a hospital.) Have victim lie down and raise feet 8 to 12 inches Do not allow victim to return to work for several days Victim should avoid further exposure to abnormally warm temperatures

The Fire Triangle

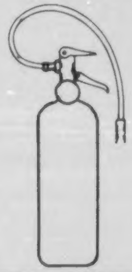
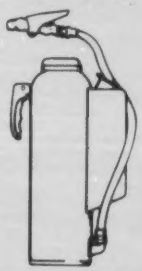
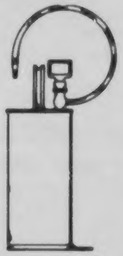
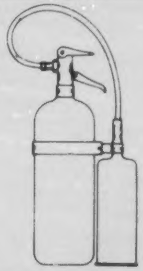
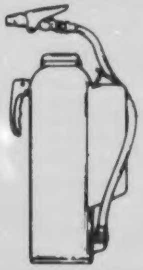
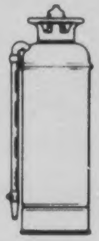
To produce fire, three things must be present at the same time.


FUEL
HEAT
OXYGEN

If any one of the three is missing, a fire cannot be started. With the removal of any one, the fire will be extinguished.


HEAT
OXYGEN
FUEL
OXYGEN
FUEL
HEAT

Types of Fire Extinguishers

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING...	...THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	**MATCH PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT** Important! Using the wrong type extinguisher for the class of fire may be dangerous.					
		Pressurized Water	**Carbon Dioxide (CO_2)**	**Multipurpose Dry Chemical**	**Dry Powder**	**Water Pump Tank**	**Foam**
*Green A **CLASS A FIRES** **Use these Extinguishers** ORDINARY COMBUSTIBLES • Wood • Paper • Cloth, Etc.							
*Red B **CLASS B FIRES** **Use these Extinguishers** FLAMMABLE LIQUIDS, GREASE • Gasoline • Paints • Oils, Etc.							

*Extinguisher labels are coded (by letter, shape, and color) to help you match the correct extinguisher to the type of fire you are fighting.

A B C D

TM #2

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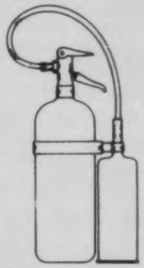
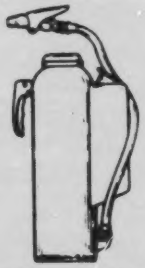
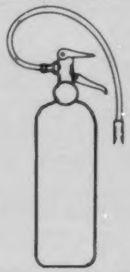
Types of Fire Extinguishers

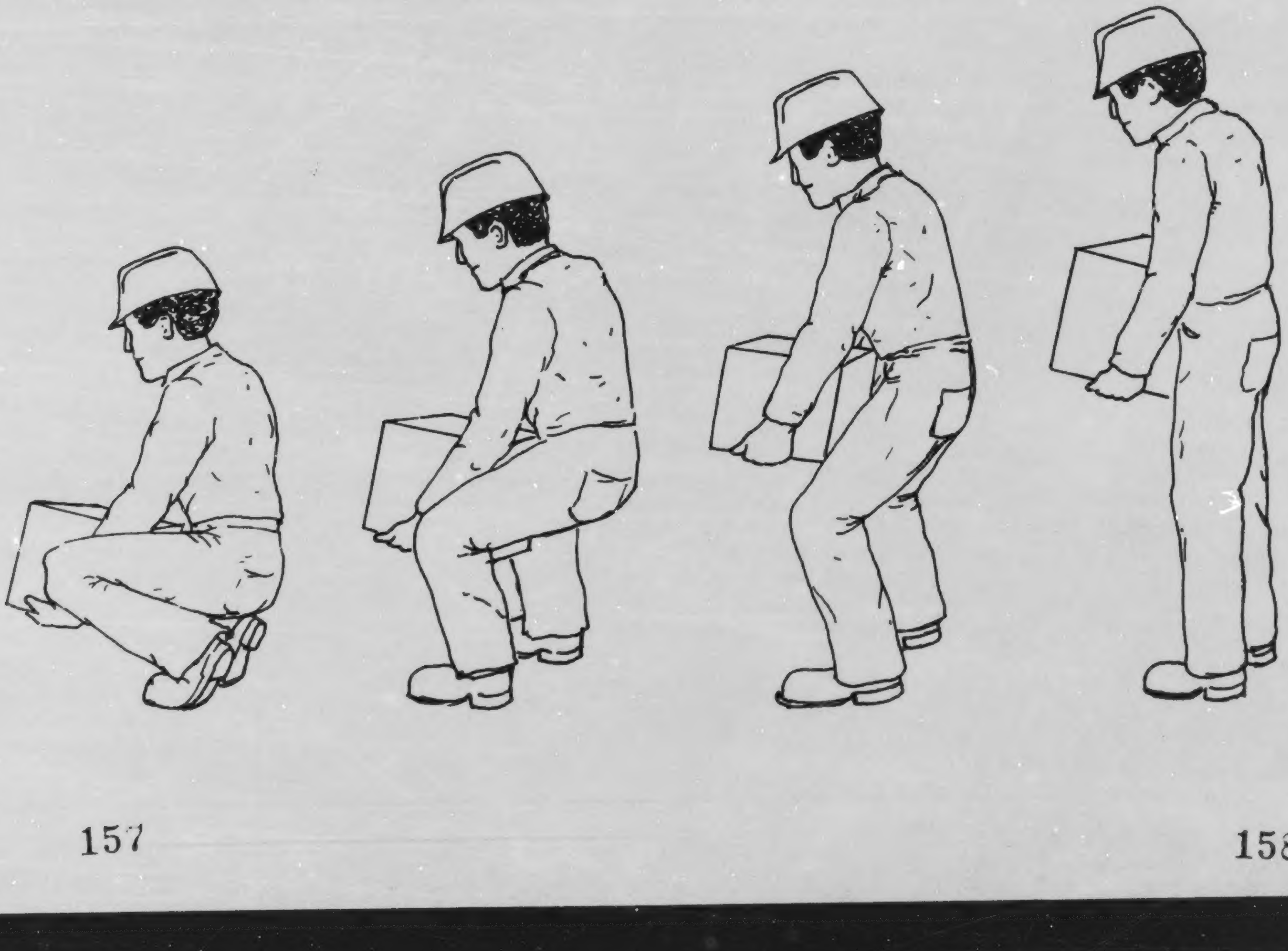
(Continued)

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
		MATCH PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important! Using the wrong type extinguisher for the class of fire may be dangerous.					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING...	...THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	**Pressurized Water**	**Carbon Dioxide (CO_2)**	**Multipurpose Dry Chemical**	**Dry Powder**	**Water Pump Tank**	**Foam**
*Blue Ⓒ **CLASS C FIRES** **Use these Extinguishers** ELECTRICAL EQUIPMENT • Motors • Switches, Etc.							
*Yellow D **CLASS D FIRES** **Use this Extinguisher** COMBUSTIBLE METALS • Iron • Magnesium							

*Extinguisher labels are coded (by letter, shape, and color) to help you match the correct extinguisher to the type of fire you are fighting.

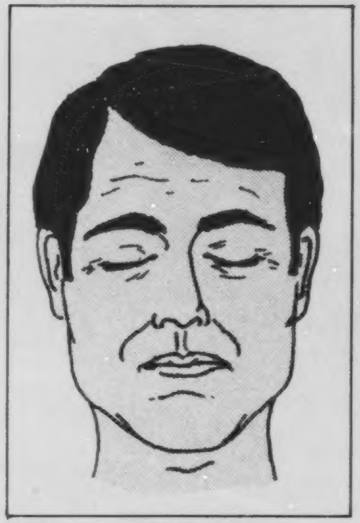
A B Ⓒ D

Correct Way to Lift Heavy Objects



Face and Skin Conditions in Heat Stroke and Heat Exhaustion

Heat Stroke

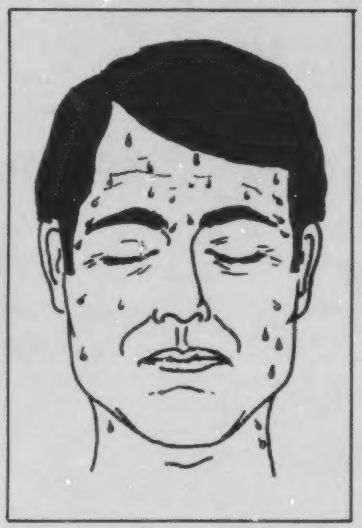


Skin Condition

Hot Red Dry

Get immediate medical help.
Cool body as quickly as possible.

Heat Exhaustion



Skin Condition

Clammy Pale Heavy Sweating

Get victim out of sun and heat, elevate feet, cool body, give sips of salt water.

TM #5

BLC - 179-A

SAFETY AND FIRST AID
UNIT VI

ASSIGNMENT SHEET #1 — COMPLETE A SAFETY PLEDGE FORM

NAME ____ SCORE ________________

Before being allowed to operate a piece of equipment, each student/employee will be given proper instruction in the use of the equipment and in the correct safety procedures concerning it. The student/employee must assume responsibility for following safe practices. We, therefore, ask that the student/employee subscribe to the following safety pledge.

A. I will follow all safety rules.

B. I will never use a machine without first having permission from the instructor or supervisor.

C. I will not ask permission to use a particular machine unless I have been instructed in its use and have scored 100 percent on the safety test for that machine.

D. I will immediately report any accident or injury, no matter how minor, to my instructor or supervisor.

Date______________________ Student's/employee's signature__________________

Date______________________ Instructor's signature__________________________

Date______________________ Supervisor's signature__________________________

Parental consent is necessary if the student/employee is under eighteen.

Date______________________ Parent's or guardian's signature__________________

SAFETY AND FIRST AID
UNIT VI

ASSIGNMENT SHEET #2 — DISTINGUISH AMONG SYMPTOMS AND TREATMENTS FOR HEAT STROKE, HEAT CRAMPS, AND HEAT EXHAUSTION

NAME ______________________________ SCORE ____________

Exposure to extreme heat combined with exertion can result in heat stroke, heat cramps, or heat exhaustion. Because each condition requires immediate recognition followed by appropriate treatment, you must be able to distinguish the different symptoms of the three conditions.

Distinguish among symptoms and treatments for heat stroke, heat cramps, and heat exhaustion. Write an "X" in the appropriate column(s).

A.	Symptom	Stroke	Cramps	Exhaustion
1.	Heavy sweating			
2.	Severe muscle cramps			
3.	Weakness, tiredness			
4.	Strong, rapid pulse			
5.	Nausea			
6.	Hot, flushed, dry skin			
7.	Possible loss of consciousness			
8.	Headache			
9.	High body temperature			
10.	Pale, clammy skin			
11.	Abdominal pain			
12.	Approximately normal body temperature			

ASSIGNMENT SHEET #2

B.

	Treatment	Stroke	Cramps	Exhaustion
1.	Exert firm pressure with your hands on the cramped muscles, or gently massage them			
2.	Have victim lie down and raise feet 8 to 12 inches			
3.	Transport to medical care as soon as possible			
4.	Loosen clothing			
5.	Remove clothing, and sponge body with cool (not cold) water or rubbing alcohol			
6.	Give *sips* of salt water			
7.	Move victim out of the sun, preferably to an air-conditioned room			
8.	Cool the body immediately			

SAFETY AND FIRST AID
UNIT VI

ASSIGNMENT SHEET #3 — ANALYZE ACCIDENT CASE STUDIES

NAME ______________________________ SCORE ______________

SAFETY IS A PERSONAL RESPONSIBILITY. Without a doubt, most accidents result from people taking careless risks. Not only can accidents cause physical harm and loss of work time, but unsafe situations and actions affect your co-workers and company.

Study each of the case studies that follow. Think through them carefully. Consider what caused the accidents, how they could have been avoided, and what "costs" were involved besides financial ones.

ASSIGNMENT SHEET #3

Case Study #1

Victim: Rodriquez Arlando, twenty-four years old, twenty-two months' experience
Job description: Using a forklift to place material on a scaffold

Accident description: Rodriquez was using a forklift to place material on top of a three-tier, 15-foot scaffold. As Rodriquez hurriedly raised the forklift, he caught the edge of the outer scaffold board. He immediately stopped the forklift, shut it down, and set the parking brake before dismounting to determine what damage he had done and the best way to repair it. As Rodriquez approached the scaffold, a concrete block fell from it and hit him on the shoulder, knocking him to the ground.

A. Assuming you have witnessed the accident and are nearby to help, what would you do first? ____________________

B. What immediate first-aid measures would you take? ____________________

C. What safety precautions did the worker observe? ____________________

D. What safety precautions did the worker fail to observe? ____________________

ASSIGNMENT SHEET #3

E. What factors may have caused the accident? ____________________

F. Could this accident have been avoided? __________ How? ____________________

G. What do you think will be some of the consequences or results of this accident? ___

ASSIGNMENT SHEET #3

Case Study #2

Victim: Jane Allen, thirty years old, five years' experience
Job description: Using a high lift to stock material on second floor of a building

Accident description: While lifting a load of precast lintels, Jane allowed the boom of the high lift to come too close to an electrical power line. Jane remained in the cab and did not touch the machine's metal structure until the boom was cleared of the wire. However, in her haste to be free of the situation, she left the cab without cutting off the power or properly locking the brakes and controls. As she dismounted, the high lift moved forward, causing a severe gash to Jane's leg.

A. Assuming that you have witnessed the accident and are nearby to help, what would you do first? ____________________

B. What immediate first-aid measures would you take? ____________________

C. What safety precautions did the worker observe? ____________________

D. What safety precautions did the worker fail to observe? ____________________

ASSIGNMENT SHEET #3

E. What factors may have caused the accident? ______________________________

____

____

____

F. Could this accident have been avoided? __________ How? ______________

____

____

____

G. What do you think will be some of the consequences or results of this accident? ____

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ASSIGNMENT SHEET #3

Case Study #3

Victim: Keith Steward, thirty-seven years old, fourteen years' experience
Job description: Setting a precast lintel

Accident description: Because of his fourteen years' experience, Keith was assigned a young trainee, Sheila Preston. Proud that he had been chosen by his supervisor to instruct the attractive trainee, Keith demonstrated the proper way to lift heavy objects. But, he attempted to lift a heavy lintel by himself. As Keith started to lift the lintel, he heard and felt his back pop and found that he could not straighten up without severe pain.

A. Assuming that you have witnessed the accident and are nearby to help, what would you do first? ______

B. What immediate first-aid measures would you take? ______

C. What safety precautions did the worker observe? ______

D. What safety precautions did the worker fail to observe? ______

ASSIGNMENT SHEET #3

E. What factors may have caused the accident? ______________________

F. Could this accident have been avoided? ________ How? ______________

G. What do you think will be some of the consequences or results of this accident? ____

SAFETY AND FIRST AID
UNIT VI

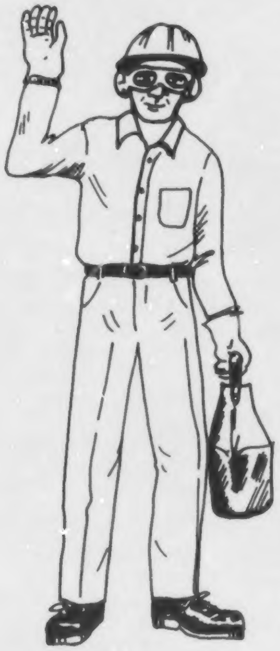
ASSIGNMENT SHEET #4 — IDENTIFY GOOD AND BAD PERSONAL SAFETY PRACTICES

NAME ______________________________ SCORE ____________

Personal safety is a very important responsibility. Failure to observe safety rules creates a hazard not only for yourself but also for your co-workers. The results can be severe accidents and even death.

Study each of the following illustrations. In the blanks below A, write all of the good personal safety practices that the worker in the illustration is observing. In the blanks below B; write all the worker's bad personal safety practices.

A. Good safety practices



1. ______________________________

2. ______________________________

3. ______________________________

ASSIGNMENT SHEET #4

4. ____________________

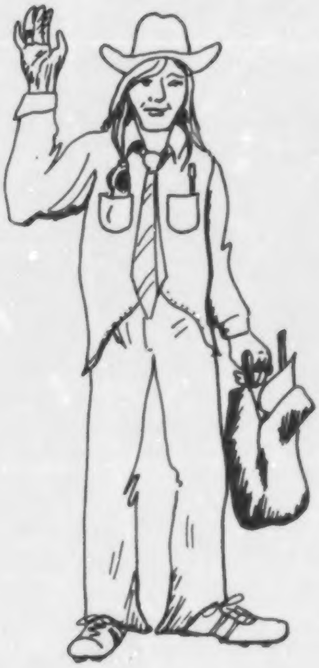
5. ____________________

6. ____________________

7. ____________________

8. ____________________

B. Bad safety practices



1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

ASSIGNMENT SHEET #4

7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

11. ______________________________

12. ______________________________

SAFETY AND FIRST AID
UNIT VI

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 — Evaluated to the satisfaction of the instructor

Assignment Sheet #2

A.	Symptom	Stroke	Cramps	Exhaustion
1.	Heavy sweating		X	X
2.	Severe muscle cramps		X	
3.	Weakness, tiredness			X
4.	Strong, rapid pulse	X		
5.	Nausea	X	X	X
6.	Hot, flushed, dry skin	X		
7.	Possible loss of consciousness	X		X
8.	Headache	X		
9.	High body temperature	X		
10.	Pale, clammy skin			X
11.	Abdominal pain		X	
12.	Approximately normal body temperature			X

C

ANSWERS TO ASSIGNMENT SHEETS

B.	Treatment	Stroke	Cramps	Exhaustion
1.	Exert firm pressure with your hands on the cramped muscles, or gently massage them		X	
2.	Have victim lie down and raise feet 8 to 12 inches			X
3.	Transport to medical care as soon as possible	X		
4.	Loosen clothing			X
5.	Remove clothing, and sponge body with cool (not cold) water or rubbing alcohol	X		
6.	Give *sips* of salt water		X	X
7.	Move victim out of the sun, preferably to an air-conditioned room or by a fan			X
8.	Cool the body immediately	X		

Assignment Sheet #3

(NOTE: These are suggested answers and should be evaluated to the satisfaction of the instructor.)

Case Study #1

A. Send someone to call for professional help

B. Observe overall emergency (Rodriquez probably suffered a broken shoulder, and possibly other injuries)

Do not move victim

Check breathing; if victim is not breathing, begin mouth-to-mouth resuscitation

Observe pupil reactions of eyes

Check for amount of bleeding and extent of wound; use techniques to stop bleeding

If victim is conscious, check alertness level, and ask about physical status

Treat for shock if necessary

ANSWERS TO ASSIGNMENT SHEETS

C. Rodriquez was using the proper piece of equipment for the job; he shut down the machine and set brakes before dismounting from the forklift

D. Rodriquez approached scaffold but was not alert in observing what was happening above

E. Rodriquez did not use good judgment, or he was careless in the use of the forklift

F. Yes; Rodriquez could have avoided the accident by being more careful when raising the load; he could have also avoided the accident by being more alert when approaching the scaffold

G. Accident results include personal injury, time lost from work, and possible delay in the work schedule

Case Study #2

A. Shut down high lift, or call someone to shut down high lift while you attend to victim

B. Observe overall emergency

Control bleeding by direct pressure (apply pressure to femoral artery, and elevate leg if bleeding is profuse)

Treat victim for shock if necessary

Use the job site's phone and list of emergency telephone numbers to report the accident and to call for professional medical help

C. Jane remained in the high lift and did not touch the metal structure until the boom was cleared from the wire

D. Jane failed to observe the recommended safe distance of separation between lift boom and power lines (after five years' experience, she should have known that it is not necessary to actually come in contact with a power line for the electrical energy to ground through the machine); she dismounted without shutting down the machine, lowering the boom, or properly locking brakes and controls

E. Jane did not observe safety precautions for working near utility lines. Also, she used poor judgment and panicked when dismounting from the high lift, and thus failed to properly shut down the machine

F. Yes; Jane could have avoided the accident by observing the safety rules pertaining to working with equipment around power lines and to leaving a machine

G. Accident results include damage to equipment, personal injury, time lost from work, and perhaps some delay in work schedule

ANSWERS TO ASSIGNMENT SHEETS

Case Study #3

A. Send Sheila Preston to use the job site phone to report accident and to call for professional medical help

B. Observe overall emergency (Keith definitely has a back injury and may have ruptured a spinal disc)

Do not try to straighten victim

Check alertness and ask about physical status

If victim feels faint or has fallen to floor, try to slip a board or other hard surface under him

Treat for shock if necessary

C. Keith assumed the proper position for lifting heavy objects

D. Keith tried to lift a very heavy object by himself

E. The accident was caused by Keith's sense of pride and his carelessness regarding safe lifting measures

F. Yes; the victim should have asked for assistance in lifting the lintel

G. Accident results include personal injury and loss of work time

Assignment Sheet #4

(NOTE: Student responses will vary, but answers should include the following.)

A. Good safety practices

1. Safety helmet
2. Safety goggles
3. Ear protection
4. Gloves
5. Close-fitting clothing
6. Safety shoes
7. Compact tool kit
8. No tools in pockets

ANSWERS TO ASSIGNMENT SHEETS

B. Bad safety practices

1. No safety helmet
2. Safety goggles in pocket
3. No gloves
4. Hands dirty
5. Rings on fingers
6. Tools sticking out of pockets
7. Long, baggy shirt sleeves
8. Shirttail hanging out
9. Sharp tools sticking out of tool bag
10. Pants cuffs too long, walking on them
11. Tennis shoes
12. Long tie

SAFETY AND FIRST AID
UNIT VI

JOB SHEET #1 — GIVE MOUTH-TO-MOUTH RESUSCITATION

I. Equipment — Resuscitation doll

(NOTE: *Do not* practice on a breathing person.)

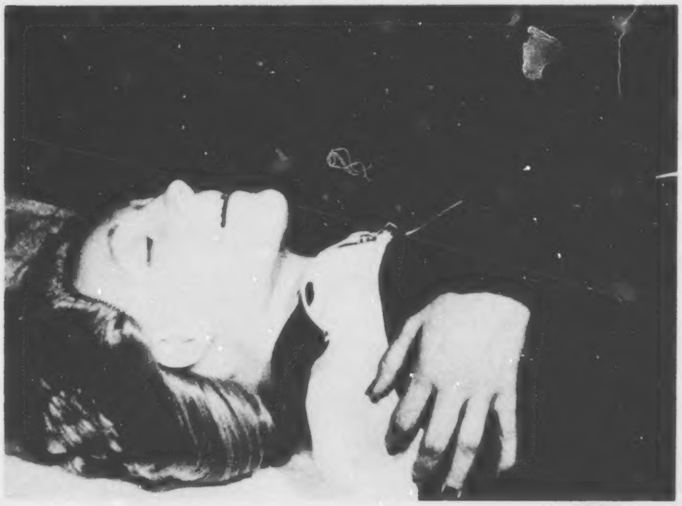
II. Procedure

A. Clear victim's air passage

1. Place victim flat on back (Figure 7)

(NOTE: If it is necessary to roll victim over, try to roll the victim over all at once, keeping back and neck straight, to avoid making any possible spinal injury worse.)

FIGURE 7

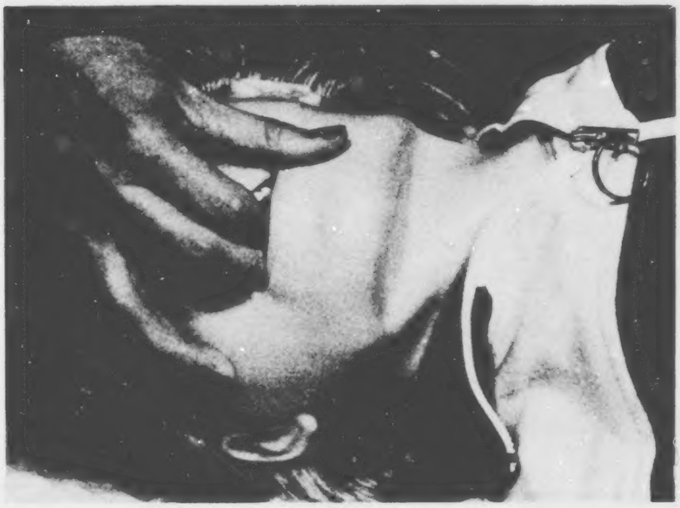


JOB SHEET #1

2. Remove all foreign objects from victim's mouth and throat (Figure 8)

   (NOTE: If there is an obstruction, carefully turn victim on side, tilt head down, and clean mouth out with your fingers. When obstruction is removed, carefully position victim onto back again.)

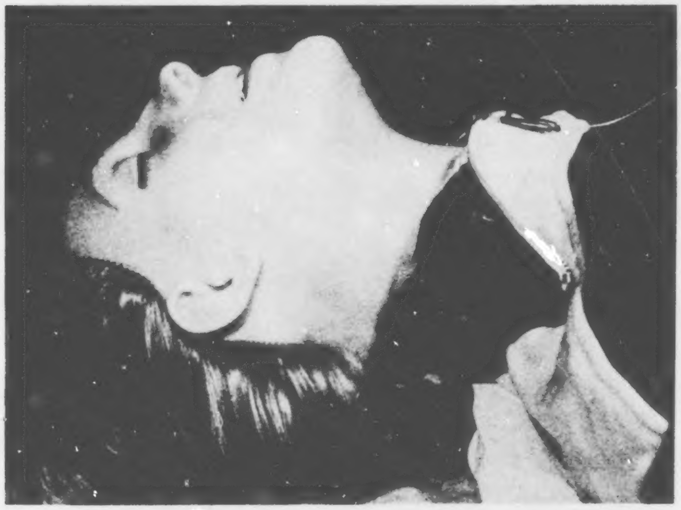
FIGURE 8



3. Kneel at the victim's side, and lift up under the neck, tilting crown of head backwards (Figure 9)

   (NOTE: If possible, place a rolled piece of clothing under the victim's shoulders; this will help to secure the backward tilt of head.)

FIGURE 9

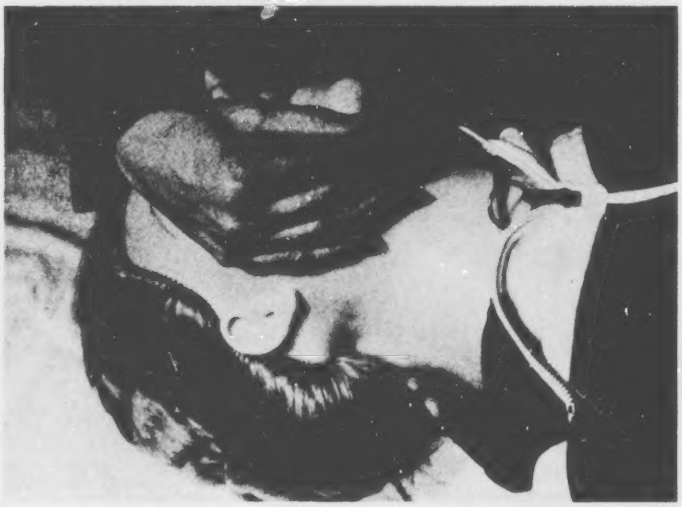


JOB SHEET #1

4. Pull victim's lower jaw so the chin points straight up (Figure 10)

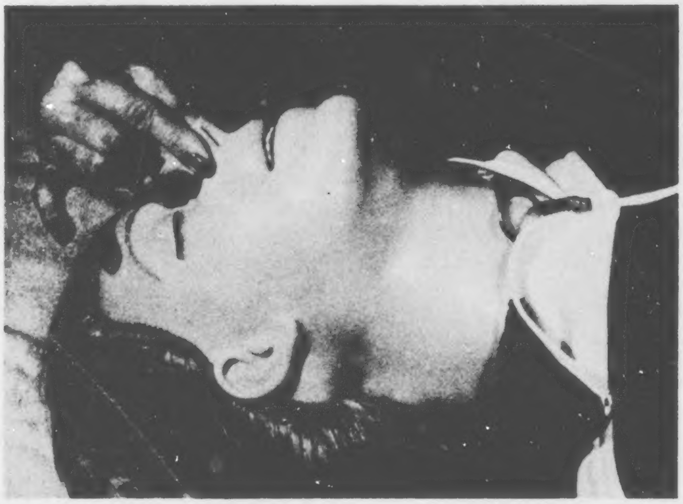
(NOTE: This will pull the tongue forward and open the air passage.)

FIGURE 10



B. Pinch victim's nostrils shut while still lifting up under the neck (Figure 11)

FIGURE 11

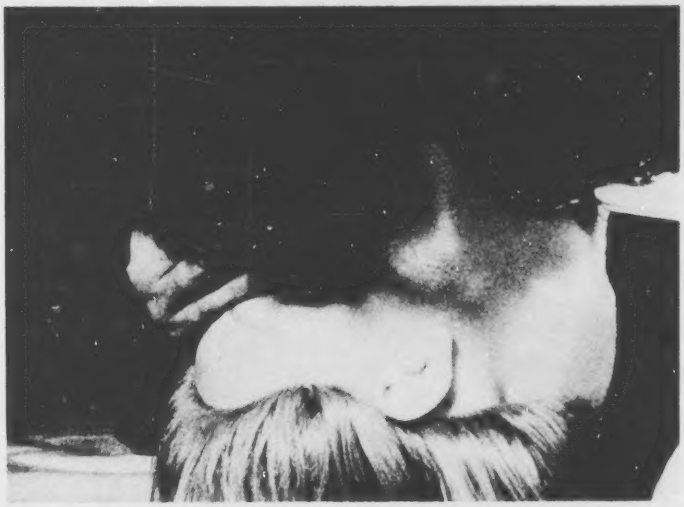


JOB SHEET #1

C. Inhale deeply, and while making an airtight seal with your mouth over the victim's mouth, breathe into victim's mouth until chest rises (Figure 12)

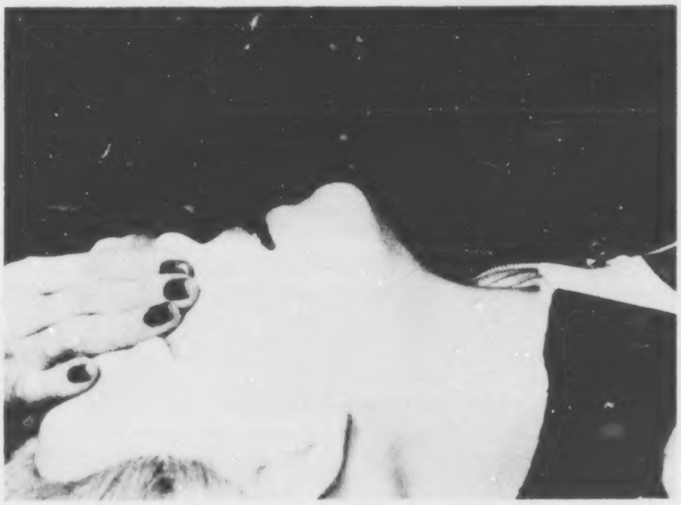
(CAUTION: Keep the victim's chin extended at all times.)

FIGURE 12



D. Remove your mouth from victim's mouth, and listen for return flow of air (Figure 13)

FIGURE 13



E. Repeat steps C and D until victim is breathing on his or her own or until medical help takes over treatment

SAFETY AND FIRST AID
UNIT VI

JOB SHEET #2 — SHOW PROPER WAY TO LIFT A HEAVY OBJECT

(NOTE: You will be given proper instructions on lifting before you attempt to lift a heavy object. You should also view the film *A New Way to Lift*.)

I. Personnel and equipment

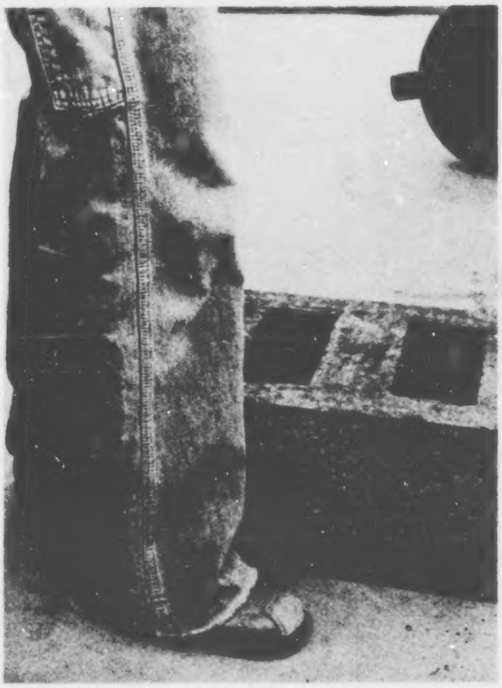
  A. A person

  B. Heavy object

II. Procedure

  A. Step up to object with feet apart; place one foot beside object and one behind (Figure 14)

FIGURE 14

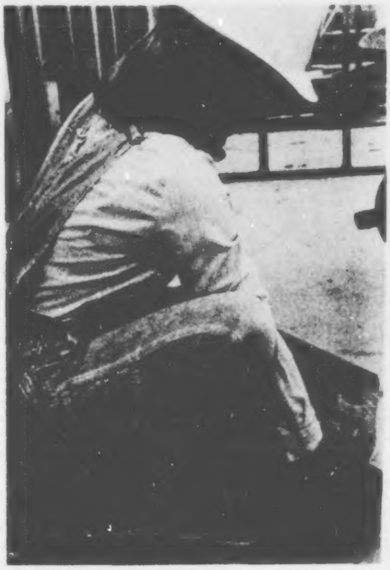


JOB SHEET #2

B. Keep back straight (Figure 15)

(NOTE: Lift with legs, not with back.)

FIGURE 15



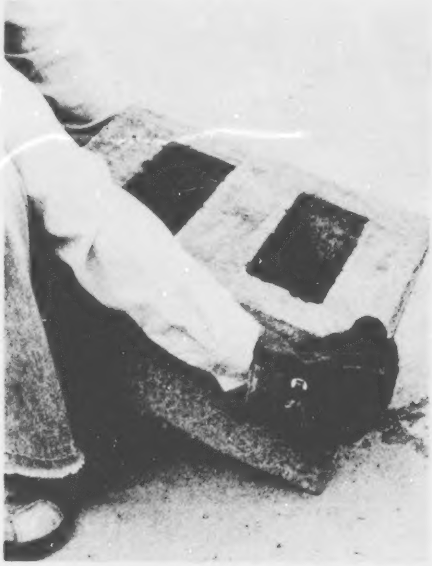
C. Tuck chin in (Figure 16)

FIGURE 16

JOB SHEET #2

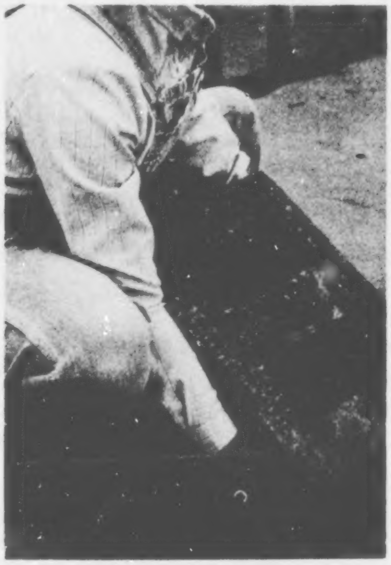
D. Grasp object with whole hand (Figure 17)

FIGURE 17



E. Tuck in elbows and arms, and hold load close to body (Figure 18)

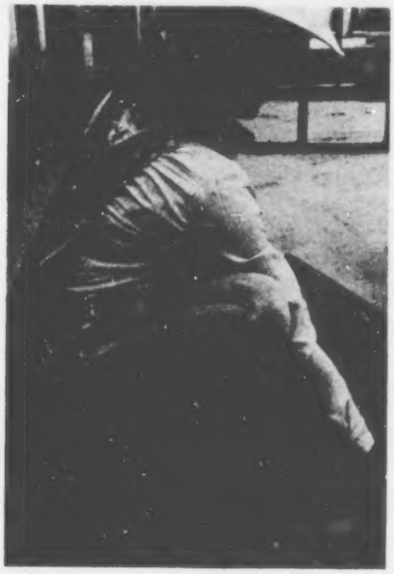
FIGURE 18



JOB SHEET #2

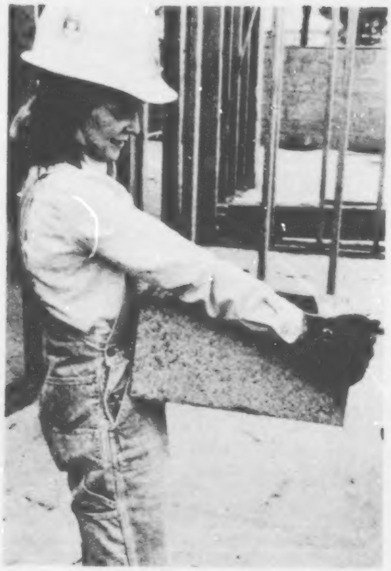
F. Keep body weight directly over feet (Figure 19)

FIGURE 19



G. Lift object (Figure 20)

FIGURE 20



SAFETY AND FIRST AID
UNIT VI

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with safety and first aid to their correct definitions. Write the correct numbers in the blanks. Terms and definitions are continued on the following page.

______a. Source of danger

______b. Capable of bursting into flame

______c. Act of bringing one back to full consciousness

______d. Condition of being unsafe

______e. To cause to cease burning

______f. Depressed condition of many of the body functions due to failure of enough blood to circulate through the body following serious injury

______g. Stored under pressure greater than the pressure of the atmosphere

______h. Device such as a bandage and stick used to check bleeding or blood flow

______i. State or condition of being safe; freedom from danger, risk, or injury

______j. Capable of being easily ignited and burning with extreme rapidity

______k. Air-powered

______l. Any suddenly occurring, unintentional event that causes injury or property damage

______m. Liquid substance capable of dissolving or dispersing one or more other substances

______n. Combined process of emission, transmission, and absorption of radiant energy

1. Carelessness
2. Flammable
3. Pressurized
4. Radiation
5. Accident
6. Combustible
7. Hazard
8. Safety
9. Shock
10. Extinguish
11. Solvent
12. Resuscitation
13. Tourniquet
14. Pneumatic

TEST

______o. Tending to explode

______p. Mine Safety and Health Administration

______q. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

______r. Occupational Safety and Health Act; federal legislation designed to ensure safe and sanitary working conditions for employees

______s. Heavy loss of blood

15. Hemorrhage
16. MSHA
17. Explosive
18. OSHA
19. First aid

2. State five personal safety rules.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

e. ______________________________

____

3. State ten job safety rules.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

TEST

d. ______________________________

____

e. ______________________________

____

f. ______________________________

____

g. ______________________________

____

h. ______________________________

____

i. ______________________________

____

j. ______________________________

____

4. State five reasons for practicing job safety.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

TEST

5. Match colors of the safety color code to their correct applications. Write the correct numbers in the blanks. Some answers may be used more than once.

______a. Designates caution and marks physical hazards

______b. Identifies fire protection equipment and its location

______c. Designates location of first-aid equipment

______d. Designates dangerous parts of equipment that may cut, crush, shock, or otherwise injure

______e. Designates caution against starting, using, or moving equipment while under repair, or against the use of defective equipment

______f. Designates traffic flow

______g. Designates radiation hazards

______h. Designates danger

1. Federal safety green
2. Federal safety white and black (used individually or in combination)
3. Federal safety orange
4. Federal safety purple
5. Federal safety red
6. Federal safety yellow

6. Select from the following list components of the fire triangle. Write an "X" in the blank before each correct answer.

______a. Fire

______b. Oxygen

______c. Carbon dioxide (CO_2)

______d. Fuel

______e. Heat

______f. Water

TEST

7. Match classes of fires to their correct descriptions. Write the correct numbers in the blanks.

_____a. Fires that occur with flammable liquids such as gasoline, oil, grease, paint, and thinners

_____b. Fires that occur in ordinary combustible materials such as wood, rags, and rubbish

_____c. Fires that occur in or near electrical equipment such as motors, switchboards, and electrical wiring

_____d. Fires that occur with combustible metals such as iron or magnesium

1. Class A
2. Class B
3. Class C
4. Class D

8. Match types of fire extinguishers to the class of fire for which each is used. Write the correct numbers in the blanks. Blanks may contain more than one number.

_____a. Used on Class A fires *only*

_____b. Used on Class B and C fires

_____c. Used on Class D fires

_____d. Used on Class A, B, and C fires

_____e. Used on Class B fires *only*

1. Pressurized water
2. Carbon dioxide (CO_2)
3. Dry powder
4. Multipurpose dry chemical
5. Water pump tank
6. Foam

9. List in correct order procedures used to lift heavy objects correctly.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

TEST

10. State three safety rules concerning flammable liquids.

a. ____

b. ____

c. ____

11. Name reasons why knowledge of first aid is important.

a. ____

b. ____

c. ____

12. Discuss reasons why first-aid skills are needed.

____

____

____

13. Arrange in order immediate steps to follow when giving first aid to an accident victim. Write a "1" before the first step, a "2" before the second step, and so on.

______a. Observe pupil reactions of the eyes

______b. Check breathing

______c. Begin definite first-aid treatment for symptom

______d. Observe overall emergency

______e. If victim is conscious, check alertness level by asking questions about victim's physical status

______f. Check pulse or heartbeat

14. Select from the following list factors to consider in first-aid treatment of shock. Write an "X" in the blank before each correct answer.

______a. Get medical help as soon as possible

______b. Help victim sit up immediately

______c. Cover victim to prevent loss of body heat and to stabilize blood circulation

______d. Give victim fluids immediately

______e. Maintain adequate supply of oxygen

TEST

15. Classify burns by degree according to their descriptions. Write a "1" for first-degree burns, a "2" for second-degree burns, and a "3" for third-degree burns.

______a. Blistering

______b. Rapid healing

______c. Mottled or red areas

______d. Charred or white appearance of burned area

______e. Damage extending into first layer of tissue

______f. Redness or discoloration

______g. Mild swelling and pain

______h. Pain greater than first degree

______i. Considerable swelling

______j. Deep tissue destruction

______k. Wet appearance of burned area due to loss of plasma

______l. Less pain due to nerve destruction

16. Match first-, second-, and third-degree burns to their correct first-aid treatments. Write the correct numbers in the blanks.

______a. Submerge the part in cold water (not ice water) until pain eases; blot dry gently and apply dry, sterile dressings; do not break blisters, and do not use any ointments, sprays, or home remedies on burned area

______b. Apply cold water, or submerge burned area in cold water; apply a dry dressing if necessary

______c. Cover burns with thick sterile dressings, but do not immerse in water; do not remove any tissue or burned clothing; transport victim to hospital as quickly as possible

1. Third degree
2. First degree
3. Second degree

TEST

17. Describe first-aid steps to follow to control bleeding by direct pressure.

a. ______________________________

____

____

b. ______________________________

____

c. ______________________________

____

____

____

d. ______________________________

____

e. ______________________________

____

18. Arrange in order steps to follow for mouth-to-mouth resuscitation. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Inhale deeply, and while making an airtight seal with your mouth over the victim's mouth, breathe into victim's mouth until chest rises

_____b. Pinch victim's nostrils shut

_____c Clear victim's air passage

_____d. Remove your mouth from victim's mouth, and listen for return flow of air

_____e. Extend victim's chin by lifting up under neck

_____f. Remove all foreign objects from victim's mouth and throat

19. State five measures to take for prevention of heat stroke, heat cramps, and heat exhaustion.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

TEST

20. Write critical information about symptoms and treatment of heat stroke, heat cramps, and heat exhaustion. Write your answers in the blanks. Chart is continued on next page.

Condition	Symptoms	Treatment
Heat Stroke	Visual disturbances Headache Nausea b. ____________ body temperature Hot, flushed, c. __________ skin Strong, rapid pulse Slow, deep breathing Offensive body odor Possible convulsions Possible loss of consciousness	a. ________________ ________________ Remove clothing, and sponge body with cool (not cold) water or alcohol Use fans, air-conditioners, or fan by hand to circulate air and promote cooling d. Provide continuous massage ________________ ________________ Give artificial respiration if needed Transport to medical care as soon as possible Do not give stimulants or alcohol Get victim to a cool place
Heat Cramps	e. ____________ pain Nausea Dizziness g. ____________ skin Heavy sweating Muscular twitching Severe muscle cramps	f. ________________ with your hands on the cramped muscles, or gently massage them Give *sips* of salt water Do not give plain (unsalted) cold drinks Do not give stimulants or alcohol

TEST

Condition	Symptoms	Treatment
Heat Exhaustion	h. ______________ body temperature i. Pale, ______________ skin Heavy sweating Nausea Possible vomiting Weakness, tiredness k. Fast, ______________ pulse Possible loss of consciousness	Move victim out of the sun, preferably to an air-conditioned room Loosen clothing Fan j. Apply ______________ cloths Give *sips* of salt water Allow fluids as desired if victim is able to swallow l. Have victim lie down and ______________ Do not allow victim to return to work for several days Victim should avoid further exposure to abnormally warm temperatures

(NOTE: Test questions 21-24 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

21. Complete a safety pledge form.

22. Analyze accident case studies.

23. Identify good and bad personal safety practices.

24. Demonstrate ability to

    a. Give mouth-to-mouth resuscitation.

    b. Show proper way to lift a heavy object.

SAFETY AND FIRST AID
UNIT VI

ANSWERS TO TEST

1.

a.	7	f.	9	k.	14	p.	16
b.	6	g.	3	l.	5	q.	19
c.	12	h.	13	m.	11	r.	18
d.	1	i.	8	n.	4	s.	15
e.	10	j.	2	o.	17		

2. Answer should include any five of the following

   a. Wear close-fitting clothing appropriate for the activity being performed

   b. Confine long hair before operating equipment

   c. Wear safety glasses, suitable hard hat, goggles, safety shoes, gloves, and respiratory equipment where required

   d. Remove ties and fasten loose sleeves when working around machine tools or rotating equipment

   e. Remove rings and other jewelry when working

   f. Use soap and water frequently as a method of preventing skin disease

   g. Be familiar with location of fire-fighting equipment and first-aid equipment

   h. Be alert, and conduct yourself in a manner that will ensure safe practices

   i. Do not carry hand tools in pockets

3. Answer should include any ten of the following

   a. Keep all tools sharp, clean, and in safe working order

   b. Retain guards and safety devices on all equipment

   c. Report defective tools, machines, or other equipment to the supervisor

   d. Report all accidents to the supervisor, regardless of nature or severity

ANSWERS TO TEST

e. Be sure that machine and equipment operators turn off power and do not leave until equipment has stopped

f. Operate a hazardous machine *only after* receiving instructions on how to operate the machine safely

g. Disconnect power from machine tools before performing service or maintenance on machine

h. Clean up any spilled liquids immediately

i. Use a solvent only after determining its properties, the kind of work it is formulated to do, and how to use it

j. Use correct, properly fitting wrenches on nuts and bolts

k. Keep work area clear of scraps and litter

l. Clean chips from saws and grinders with a brush, not with your hands or a rag; *do not* clean while machine is running

m. Do not use compressed air to clean yourself or your clothing

n. Use only approved scaffolding

o. Use a swing scaffold only after proper instructions and in accordance with OSHA regulations

p. Be conscious of others' safety

q. Obey all safety rules, and observe limitations on equipment according to specifications and manufacturer's regulations

r. Never operate equipment or part of equipment within 20 feet of any electrical power line or power source or as specified by local safety codes or regulations

4. Answer should include any five of the following

a. Preventing physical harm to yourself and others

b. Avoiding loss of work

c. Avoiding possible loss of pay

d. Lowering cost to employer

e. Preventing loss of or damage to equipment and/or materials

ANSWERS TO TEST

f. Lowering insurance rates

g. Preventing hardship on family

h. Providing regular job schedules

i. Preventing possible loss of job

5. a. 6 e. 6
b. 5 f. 2
c. 1 g. 4
d. 3 h. 5

6. b, d, e

7. a. 2 c. 3
b. 1 d. 4

8. a. 1,5 d. 4
b. 2 e. 6
c. 3

9. a. Step up to object with feet apart; place one foot beside object and one behind
b. Lift with legs, not with back
c. Keep back straight, nearly vertical
d. Tuck chin in
e. Grasp object with whole hand
f. Tuck elbows and arms in
g. Hold load close to body
h. Keep body weight directly over feet
i. Lift object

ANSWERS TO TEST

10. Answer should include any three of the following
    a. Know location and use of fire extinguishers for flammable liquids
    b. Store all flammable liquids in approved safety containers
    c. Do not operate an engine that is leaking gasoline
    d. Change oil- or gasoline-soaked clothing immediately
    e. Do not fuel a running gasoline engine

11. a. May mean the difference between life and death
    b. May mean the difference between temporary and permanent injuries
    c. Teaches one what to do and what not to do in an emergency

12. Discussion should include the following
    a. Accidents are the number one cause of death
    b. There may not be time to wait for professional medical help after an accident
    c. Safety awareness needs to be promoted on the job

13.

13.	a.	4	d.	1
	b.	2	e.	5
	c.	6	f.	3

14. a, c, e

15.	a.	2	e.	2	i.	2
	b.	1	f.	1	j.	3
	c.	2	g.	1	k.	2
	d.	3	h.	2	l.	3

16.	a.	3
	b.	2
	c.	1

ANSWERS TO TEST

17. Description should include the following

    a. Apply dressing (prepared gauze, clean handkerchief, clean articles of clothing) to area, using firm pressure with hand

    b. Check frequently to see if bleeding has stopped or slowed

    c. If bleeding is still active, apply a pressure bandage by holding the dressing in place with one hand, wrapping bandage directly over and around the injured area, and tying the knot over the wounded area

    d. If injury is to a limb, elevate limb, if possible, above the level of the victim's heart

    e. If bleeding continues, apply pressure on the main artery that supplies blood to the injured area

18.

a.	5	d.	6
b.	4	e.	3
c.	1	f.	2

19. Answer should include any five of the following

    a. Drink plenty of fluids

    b. Increase salt intake

    c. Do not overexert

    d. Wear lightweight clothing

    e. Keep head covered and face shaded

    f. Take frequent, short work breaks

    g. Rest in shade whenever possible

20. a. Cool the body immediately

    b. High

    c. Dry

    d. Toward the heart

    e. Abdominal

    f. Exert firm pressure

ANSWERS TO TEST

g. Pale

h. Approximately normal

i. Clammy

j. Cool, wet

k. Weak

l. Raise feet 8 to 12 inches

21. Evaluated to the satisfaction of the instructor

22. Evaluated to the satisfaction of the instructor

23. Evaluated to the satisfaction of the instructor

24. Performance skills evaluated to the satisfaction of the instructor

BASIC MATH
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to solve basic math problems. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with basic math to their correct definitions.
2. Match symbols used in math problems to their correct descriptions.
3. Solve addition problems.
4. Solve subtraction problems.
5. Solve multiplication problems.
6. Solve division problems.
7. Distinguish among types of fractions.
8. Convert numbers and improper fractions.
9. Reduce fractions to lowest terms.
10. Add fractions.
11. Find lowest common denominators.
12. Subtract fractions.
13. Multiply fractions.
14. Divide fractions.
15. Write the place value of decimals.
16. Add decimals.
17. Subtract decimals.
18. Multiply decimals.

OBJECTIVE SHEET

19. Divide decimals.
20. Convert fractions to decimals and percentages.
21. Convert decimals to fractions and percentages.
22. Convert percentages to fractions and decimals.
23. Solve percentage problems.
24. Match terms associated with geometric figures to their correct definitions.
25. Match types of geometric figures to their correct descriptions.
26. Match units of measure to their correct definitions.
27. Calculate area of geometric figures.
28. Calculate volume of solid figures.
29. Solve basic ratio and proportion problems.

BASIC MATH
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities

- A. Obtain transparencies.

  (NOTE: Transparencies are available from AGC and CIMC.)

- B. Provide students with objective sheet.
- C. Discuss unit and specific objectives.
- D. Provide students with information and assignment sheets.
- E. Discuss information and assignment sheets.
- F. Provide students with pocket-sized chart of decimal equivalents.
- G. Give test.

  (NOTE: It is recommended that this test be given in parts, such as the math processes, fractions, and decimals.)

- H. Complete appropriate section of competency profiles.

  (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
  1. TM #1 — Area
  2. TM #2 — Ratio and Proportion
  3. TM #3 — Decimal Equivalents
- E. Assignment sheets
  1. Assignment Sheet #1 — Solve Addition Problems
  2. Assignment Sheet #2 — Solve Subtraction Problems

SUGGESTED ACTIVITIES

3. Assignment Sheet #3 — Solve Multiplication Problems
4. Assignment Sheet #4 — Solve Division Problems
5. Assignment Sheet #5 — Determine Parts of Fractions
6. Assignment Sheet #6 — Convert Fractions
7. Assignment Sheet #7 — Reduce Fractions to Lowest Terms
8. Assignment Sheet #8 — Find Common Denominators
9. Assignment Sheet #9 — Add Fractions
10. Assignment Sheet #10 — Subtract Fractions
11. Assignment Sheet #11 — Multiply Fractions
12. Assignment Sheet #12 — Divide Fractions
13. Assignment Sheet #13 — Solve Addition Problems with Decimals
14. Assignment Sheet #14 — Solve Subtraction Problems with Decimals
15. Assignment Sheet #15 — Solve Multiplication Problems with Decimals
16. Assignment Sheet #16 — Solve Division Problems with Decimals
17. Assignment Sheet #17 — Write Fractions as Decimals and Percentages
18. Assignment Sheet #18 — Write Decimals as Fractions and Percentages
19. Assignment Sheet #19 — Write Percentages as Fractions and Decimals
20. Assignment Sheet #20 — Solve Percentage Problems
21. Assignment Sheet #21 — Find Percentages of Whole Numbers
22. Assignment Sheet #22 — Calculate Areas
23. Assignment Sheet #23 — Determine Volume by Counting
24. Assignment Sheet #24 — Calculate Volume, Using a Formula
25. Assignment Sheet #25 — Estimate Cubic Yards

SUGGESTED ACTIVITIES

26. Assignment Sheet #26 — Solve Basic Ratio and Proportion Problems

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

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B. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator Instructional Materials,* Vol. I. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1981.

C. Morrison, Phyllis. *Basic Math Skills.* New York: McGraw-Hill Book Company, 1972.

D. Turcotte, Raymond J. *Bricklaying Curriculum Instructional Units.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1977.

BASIC MATH
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Calculate — To solve by mathematical process

B. Caret (‸) — Symbol that indicates where something is to be inserted

C. Decimal — Fraction based on the number 10; not written as common fraction

EXAMPLES: $^{1}/_{10} = 0.1$

$^{6}/_{100} = 0.06$

$^{3}/_{1000} = 0.003$

D. Digit — Any one of the ten Arabic numerals, 0 to 9, by which all numbers may be expressed

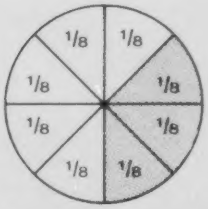
E. Division — Opposite (inverse) operation of multiplication

EXAMPLE: $16 \div 2 = 8$

F. Fraction — Part of a whole; represents one or more equal parts of a unit

EXAMPLE: If the unit is divided into eight equal parts, then each part is one-eighth ($^{1}/_{8}$) of the unit; the fraction three-eighths ($^{3}/_{8}$) means three of the parts, as shown in the shaded portion of Figure 1 below.

FIGURE 1



G. Integer — Zero or any positive or negative whole number

EXAMPLES: 4, −4, 0

INFORMATION SHEET

H. Multiplication — Abbreviated process of adding an integer to itself a specified number of times

EXAMPLE: $6 \times 3 = 18$ $(6 + 6 + 6 = 18)$

I. Percent — One part in a hundred; reckoned on basis of a whole divided into one hundred parts

J. Problem — Mathematical proposition

K. Proportion — Relationship of one ratio to another

EXAMPLE: 1:1:3 is the same proportion as 0.50: 0.50: 1.50

L. Ratio — Relationship in quantity, amount, or size between two or more things; expressed with ratio symbol or division bar

EXAMPLES: 1 part cement to 1 part lime to 3 parts sand = 1:1:3

$a{:}b$ or $\frac{a}{b}$

M. Subtraction — Process of deducting one number from another; opposite (inverse) operation of addition

N. Unit — First digit to the left of decimal

II. Symbols used in math problems

	Name of Symbol	**Symbol(s)**
A.	Addition	+
B.	Subtraction	−
C.	Division	÷ $\overline{)\quad}$
D.	Multiplication	×
E.	Equal	=
F.	Decimal	.
G.	Percent	%
H.	Caret	∧

III. Addition (Assignment Sheet #1)

A. Write units under units, tens under tens, and so on

B. Begin adding at the far right column, and move to the left

INFORMATION SHEET

C. If sum of any column is ten or more, write last figure of sum and carry other figure to next column

EXAMPLES:

$$\begin{array}{r} 1420 \\ 15 \\ +\ 123 \\ \hline 1558 \end{array} \qquad \begin{array}{r} 1 \\ 1352 \\ 17 \\ +\ 260 \\ \hline 1629 \end{array} \xleftarrow{\text{Carried figure}}$$

IV. Subtraction (Assignment Sheet #2)

A. Write units under units, tens under tens, and so on

B. Begin subtracting at the far right column, and move to the left

EXAMPLE:

$$\begin{array}{r} 784 \\ -\ 431 \\ \hline 353 \end{array}$$

C. When digits in the bottom figure are larger than the corresponding digits in the top figure, "borrow" one unit from the top number of the next column

EXAMPLE:

$$\begin{array}{r} 723 \\ -254 \\ \hline 469 \end{array} \qquad \begin{array}{r} \overset{6}{\cancel{7}}\overset{11}{\cancel{2}}\overset{13}{\cancel{3}} \\ -254 \\ \hline 469 \end{array} \qquad \begin{array}{r} 13 - 4 = 9 \\ 11 - 5 = 6 \\ 6 - 2 = 4 \end{array}$$

You cannot subtract 4 from 3 because 4 is greater than 3. Therefore, you must borrow 1 ten or 10 units from the tens column and add this to the 3 units, giving a total of 13 units. Repeat this process when subtracting the 5, borrowing 100 from the hundreds column.

D. Check subtraction by adding the answer (difference) and the number just above it

(NOTE: The sum must be the same as the top number in the problem for the answer to be correct.)

EXAMPLE: Problem

$$\begin{array}{r} 634 \\ -418 \\ \hline 216 \end{array}$$

Check

$$\begin{array}{r} 418 \\ +216 \\ \hline 634 \end{array}$$

V. Multiplication (Assignment Sheet #3)

A. Write the larger factor (multiplicand) above the smaller factor (multiplier)

(NOTE: Write units under units, tens under tens, and so on.)

B. If multiplier has only one digit, multiply each number in multiplicand by this digit, starting from right and working in order to the left

1. Multiply unit digit of multiplicand by multiplier

INFORMATION SHEET

2. Record the unit digit of the results under the digit of multiplicand, and carry the tens digit of the result

EXAMPLE:

$$\begin{array}{lr} & 1 \leftarrow \text{Carried figure} \\ \text{Multiply by one figure} & 53 \\ & \uparrow \\ 4 \times 53 = 212 & \times\ 4 \\ \hline & 2 \end{array}$$

3. Multiply the second digit of multiplicand by the multiplier and add the carried figure to the result

EXAMPLE:

$$\begin{array}{r} 1 \leftarrow \text{Carried figure} \\ 53 \\ \nwarrow \\ \times\ 4 \\ \hline 212 \end{array}$$

4. Continue working to the left until all digits in multiplicand have been multiplied

C. If multiplier has more than one digit, find partial products first and then total product

1. Multiply each digit in multiplicand by first digit on far right of multiplier; record partial product, writing the last digit of result under the unit digit of multiplicand

EXAMPLE:

$$\begin{array}{rl} 174 & \\ \times\ 42 & \\ \hline 348 & \text{Partial product} \end{array}$$

2. Multiply each number in multiplicand by second digit from right in multiplier; record partial product, writing the last digit of result under the second digit of multiplicand

(NOTE: Place the partial product under the second digit of multiplier. There will be a blank space beside the second partial product under the unit digit of first partial product.)

EXAMPLE:

$$\begin{array}{rl} 174 & \\ \times\ 42 & \\ \hline 348 & \text{Partial product} \\ 696 & \text{Partial product} \end{array}$$

3. Continue as above until each digit in the multiplier has multiplied the top digits

4. Add the partial products

EXAMPLE:

$$\begin{array}{rl} 174 & \\ \times\ 42 & \\ \hline 348 & \\ 696 & \\ \hline 7308 & = \text{Product} \end{array}$$

INFORMATION SHEET

VI. Division (Assignment Sheet #4)

A. Write inside the frame the number to be divided (dividend); write the number you are dividing by (divisor) on the outside of frame

EXAMPLE: 1984 ÷ 6 $6\overline{)1984}$

B. Determine how many times number on outside will go into the first digit on the inside; if it will not go into the first digit, determine how many times it will go into first two digits; write this figure on top of frame above right-hand digit of number it went into

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 3 \\ 6\overline{)1984} \end{array}$$

C. Multiply divisor by number on top; write results under the digits the outside number went into, and subtract these figures

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 3 \\ 6\overline{)1984} \\ \underline{18} \\ 1 \end{array}$$

D. Bring down the next digit; determine how many times divisor will go into bottom figure, and write that number above the digit that was brought down

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 33 \\ 6\overline{)1984} \\ \underline{18} \\ 18 \end{array}$$

E. Multiply divisor by the last digit you wrote on top; write results under the digits that the outside number went into; subtract these numbers

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 33 \\ 6\overline{)1984} \\ \underline{18} \\ 18 \\ \underline{18} \\ 0 \end{array}$$

F. Bring down next digit; determine how many times the divisor will go into it and write that number above digit that was brought down; multiply times the number on outside; write the results and subtract

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 330 \\ 6\overline{)1984} \\ \underline{18} \\ 18 \\ \underline{18} \\ 04 \\ \underline{0} \\ 4 \end{array}$$

INFORMATION SHEET

G. Continue the same process until all numbers in the dividend are used

H. Write the difference from the last subtraction process as a remainder (R)

EXAMPLE: 1984 ÷ 6

$$\begin{array}{r} 330 \\ 6\,\overline{)\,1984} \\ \underline{18} \\ 18 \\ \underline{18} \\ 04 \\ \underline{0} \\ 4 \end{array}$$

1984 ÷ 6 = 330, R4

I. Check answer by multiplying the answer (quotient) by the divisor and adding any remainder

EXAMPLE: Check

$$\begin{array}{r} 330 \\ \underline{\times\ 6} \\ 1980 \\ \underline{+\ 4} \\ 1984 \end{array}$$

VII. Types of fractions (Assignment Sheet #5)

A. Single fractions

1. Proper — Top number of fraction (numerator) is smaller than the bottom number of fraction (denominator)

   EXAMPLE: $\frac{8}{9}$ (8 = numerator; 9 = denominator)

2. Improper — Top number of fraction (numerator) is larger than, or equal to, the bottom number of fraction (denominator)

   EXAMPLES: $\frac{8}{6}$; $\frac{7}{7}$

3. Mixed number — Number is composed of a whole number and a proper fraction

   EXAMPLES: $9\frac{1}{2}$; $4\frac{2}{3}$; $1\frac{7}{8}$

B. Groups of fractions

1. Common — Two or more fractions that share the same denominator; sometimes called *like fractions*

   EXAMPLES: $\frac{3}{8}$ and $\frac{2}{8}$ $\frac{2}{5}$ and $\frac{3}{5}$

INFORMATION SHEET

2. Uncommon — Two or more fractions that have different denominators; sometimes called *unlike fractions*

EXAMPLES: $\frac{3}{8}$ and $\frac{2}{5}$ $\frac{1}{4}$ and $\frac{1}{5}$

VIII. Converting numbers and improper fractions (Assignment Sheet #6)

A. Mixed number to improper fraction

1. Multiply denominator of fraction by the whole number

2. Add numerator of the fraction

(NOTE: This number becomes the numerator.)

EXAMPLES:

$$4\frac{3}{5} = \frac{(5 \times 4) + 3}{5} = \frac{20 + 3}{5} = \frac{23}{5}$$

$$7\frac{1}{2} = \frac{(2 \times 7) + 1}{2} = \frac{14 + 1}{2} = \frac{15}{2}$$

B. Whole number to improper fraction

1. Choose a denominator

(NOTE: Any number may be used.)

2. Multiply the whole number by the denominator and place the answer (product) over the denominator

EXAMPLES: 8 expressed in fourths

$$8 = \frac{(8 \times 4)}{4} = \frac{32}{4}$$

1 expressed in sixteenths

$$1 = \frac{(16 \times 1)}{16} = \frac{16}{16}$$

INFORMATION SHEET

C. Improper fraction to mixed number or whole number

1. Divide numerator by denominator and write quotient as whole number

2. If there is a remainder, form a fraction by placing the remainder over the original denominator

EXAMPLES: $\frac{22}{5} = 22 \div 5$

$= 4, R2$

$= 4\frac{2}{5}$

$\frac{7}{7} = 7 \div 7$

$= 1$

IX. Reducing fractions to lowest terms — Divide the numerator and denominator by a whole number that will go into each of them evenly (Assignment Sheets #7 and #8)

EXAMPLE: $^4/_6$ is not reduced to lowest terms because both the numerator (4) and the denominator (6) can be divided by 2.

$$\frac{4}{6} = \frac{(4 \div 2)}{(6 \div 2)}$$

$$= \frac{2}{3}$$

$^2/_3$ is reduced as low as it can be because the numerator (2) and the denominator (3) cannot be divided by the same number.

X. Adding fractions (Assignment Sheet #9)

A. Common fractions

1. Add the numerators

2. Place sum over common denominator

EXAMPLE: $\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$

3. Reduce to lowest terms if necessary

B. Uncommon fractions

1. Change fractions so that they have a common denominator

(NOTE: The easiest way to find a common denominator is to multiply the denominators together and then convert the numerators. However, sometimes this method overlooks the *lowest* common denominator, and the fractions will have to be reduced.)

INFORMATION SHEET

2. Add as with common fractions

EXAMPLE:
$$\begin{aligned}\frac{1}{3} + \frac{2}{5} &= \frac{(1 \times 5)}{(3 \times 5)} + \frac{(2 \times 3)}{(5 \times 3)} \\ &= \frac{5}{15} + \frac{6}{15} \\ &= \frac{11}{15}\end{aligned}$$

3. Reduce to lowest terms

C. Mixed numbers

1. Add whole numbers
2. Add fractions
3. Combine these two answers

EXAMPLES:
$$\begin{aligned}3\frac{1}{7} + 7\frac{2}{7} &= (3 + 7) + \left(\frac{1}{7} + \frac{2}{7}\right) \\ &= 10 + \frac{3}{7} \\ &= 10\frac{3}{7}\end{aligned}$$

$$\begin{aligned}4\frac{2}{3} + 1\frac{5}{6} &= (4 + 1) + \left(\frac{2}{3} + \frac{5}{6}\right) \\ &= 5 + \left(\frac{4}{6} + \frac{5}{6}\right) \\ &= 5 + \frac{9}{6} \\ &= 5 + 1\frac{3}{6} \\ &= 5 + 1\frac{1}{2} \\ &= 6\frac{1}{2}\end{aligned}$$

4. Reduce to lowest terms

INFORMATION SHEET

XI. Lowest common denominators (Assignment Sheet #8)

(NOTE: The lowest common denominator [LCD] of two or more fractions is the lowest number that can be divided evenly by the denominators of each fraction.)

A. Change fractions to equivalent fractions with the same denominator

1. Raise a fraction to one with a higher denominator by multiplying both the numerator and denominator by the same number

(NOTE: Multiplying both terms of a fraction by the same number is the same as multiplying them by the number 1 and does not change the value of the fraction.)

EXAMPLE: $\frac{3}{4}$ and $\frac{1}{8}$ = $\frac{(3 \times 2)}{(4 \times 2)}$ and $\frac{1}{8}$

= $\frac{6}{8}$ and $\frac{1}{8}$

2. Reduce a fraction to one with a lower denominator by dividing both the numerator and denominator by the same number

(NOTE: Dividing both terms of a fraction by the same number is the same as dividing them by the number 1 and does not change the value of the fraction.)

EXAMPLE: $\frac{16}{32}$ and $\frac{5}{16}$ = $\frac{(16 \div 2)}{(32 \div 2)}$ and $\frac{5}{16}$

= $\frac{8}{16}$ and $\frac{5}{16}$

B. Reduce fractions to lowest terms that still have a common denominator

EXAMPLES: For $^3/_{10}$ and $^1/_3$, some common denominators are 30, 60, and 90. Thirty is the lowest number that can be divided evenly by 10 and 3.

For $^5/_{12}$ and $^3/_8$ and $^2/_9$, two common denominators are 72 and 144. The lowest common denominator is 72, the lowest number that can be divided evenly by 12, 8, and 9.

XII. Subtracting fractions (Assignment Sheet #10)

A. Common fractions

1. Subtract the numerators

2. Place difference over denominator

INFORMATION SHEET

3. Reduce to lowest terms

EXAMPLE:

$$\begin{array}{r} \frac{7}{11} \\ -\ \frac{1}{11} \\ \hline \frac{6}{11} \end{array}$$

B. Uncommon fractions

1. Change fractions to equivalent fractions with common denominators
2. Subtract the numerators
3. Place difference over common denominator
4. Reduce to lowest terms

EXAMPLE:

$$\frac{2}{3} - \frac{1}{2} = \frac{(2 \times 2)}{(3 \times 2)} - \frac{(1 \times 3)}{(2 \times 3)}$$

$$= \frac{4}{6} - \frac{3}{6}$$

$$= \frac{1}{6}$$

C. Mixed numbers

1. Change mixed numbers to improper fractions
2. Change improper fractions to common fractions if necessary
3. Subtract the fractions
4. Reduce answer if possible

EXAMPLE:

$$5\frac{1}{3} - 3\frac{1}{2} = \frac{16}{3} - \frac{7}{2}$$

$$= \frac{32}{6} - \frac{21}{6}$$

$$= \frac{11}{6}$$

$$= 1\frac{5}{6}$$

XIII. Multiplying fractions (Assignment Sheet #11)

A. Change mixed numbers to improper fractions if necessary

B. Multiply the numerators and denominators separately

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C. Write the product of the numerators over the product of the denominators

D. Convert improper fractions to mixed numbers if necessary

E. Reduce to lowest terms

EXAMPLES:

$$\frac{2}{3} \times \frac{1}{2} = \frac{2 \times 1}{3 \times 2}$$

$$= \frac{2}{6}$$

$$= \frac{(2 \div 2)}{(6 \div 2)}$$

$$= \frac{1}{3}$$

$$1\frac{1}{4} \times \frac{1}{2} = \frac{5}{4} \times \frac{1}{2}$$

$$= \frac{5 \times 1}{4 \times 2}$$

$$= \frac{5}{8}$$

XIV. Dividing fractions (Assignment Sheet #12)

A. Invert the divisor

B. Multiply the numerators and denominators separately

C. Write the product of the numerators over the product of the denominators

D. Reduce to lowest terms

EXAMPLES:

$$\frac{7}{8} \div \frac{1}{4} = \frac{7}{8} \times \frac{4}{1}$$

$$= \frac{28}{8}$$

$$= 3\frac{4}{8}$$

$$= 3\frac{1}{2}$$

$$1\frac{1}{4} \div \frac{1}{2} = \frac{5}{4} \times \frac{2}{1}$$

$$= \frac{10}{4}$$

$$= 2\frac{2}{4}$$

$$= 2\frac{1}{2}$$

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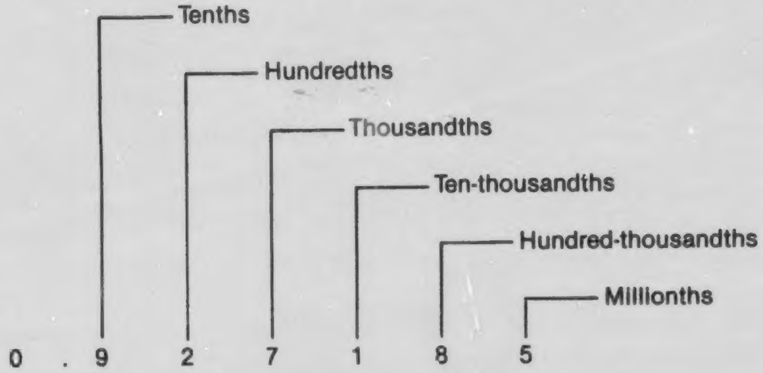
XV. Place value of decimals


Tenths
Hundredths
Thousandths
Ten-thousandths
Hundred-thousandths
Millionths
0 . 9 2 7 1 8 5

EXAMPLE: In the number above, the place values are

Tenths = 9/10

Hundredths = 2/100

Thousandths = 7/1000

Ten-thousandths = 1/10000

Hundred-thousandths = 8/100000

Millionths = 5/1000000

The number is read as nine hundred twenty-seven thousand, one-hundred eighty-five millionths (0.927185).

XVI. Adding decimals (Assignment Sheet #13)

A. Write the given numbers in a column with the decimal points directly under each other

(NOTE: Whole numbers, such as 7 or 75 or 753, have *understood* decimal points, such as 7.00 or 75.00 or 753.00.)

B. Add each column of numbers the same way as for regular whole numbers

INFORMATION SHEET

C. Locate the decimal point in the answer by placing it directly under the decimal points above

EXAMPLE: 0.857 + 2.1 + 370.057 + 753 = 1126.014

$$\begin{array}{r} 0.857 \\ 2.1 \\ 370.057 \\ +\ 753. \\ \hline 1126.014 \end{array} \qquad \text{OR} \qquad \begin{array}{r} 0.857 \\ 2.100 \\ 370.057 \\ +\ 753.000 \\ \hline 1126.014 \end{array}$$

(NOTE: Zeros may be added so that each number has the same number of decimal places.)

XVII. Subtracting decimals (Assignment Sheet #14)

A. Solving problems

1. Write the given numbers so that the decimal points are under each other

   (NOTE: Zeros may be added so that each number has the same number of decimal places.)

2. Subtract each column of numbers the same as for regular whole numbers

3. Locate the decimal point in the difference by placing it under the decimal points above

B. Checking problems

1. Add the difference and the number just above it

2. Notice that the sum must be the same as the top number in the problem for the answer to be correct

EXAMPLE:

$$\begin{array}{r} 8.120 \\ -\ 1.397 \\ \hline 6.723 \end{array} \qquad \text{Check} \qquad \begin{array}{r} 1.397 \\ +\ 6.723 \\ \hline 8.120 \end{array}$$

XVIII. Multiplying decimals (Assignment Sheet #15)

A. Multiply the same as for whole numbers

(NOTE: In setting up multiplication problems, you do not need to place the decimal points in columns.)

INFORMATION SHEET

B. Total the number of decimal places to the right of the decimal points in the factors being multiplied

C. Locate the decimal point in the product by starting at the extreme right digit in the answer and counting off as many places to the left as the total found in Step B indicates

EXAMPLES: Multiply 27.935 by 7.07

$$\begin{array}{rl} 27.935 & \text{— 3 places} \\ \underline{\times \quad 7.07} & \text{— 2 places} \\ 1\;95545 & \\ \underline{195\;5450} & \\ 197.50045 & \text{— 5 places} \end{array}$$

Multiply 2.31 by 0.041

$$\begin{array}{rl} 2.31 & \text{— 2 places} \\ \underline{\times \quad 0.041} & \text{— 3 places} \\ 231 & \\ \underline{924} & \\ 0.09471 & \text{— 5 places} \end{array}$$

XIX. Dividing decimals (Assignment Sheet #16)

A. Dividing a decimal by a decimal

1. Count the number of digits to the right of the decimal point in the divisor
2. Place a caret (^) at the end of the number
3. Count as many digits to the right of the decimal point in the dividend as you counted in the divisor
4. Place a caret after the last digit you count

   (NOTE: You may need to place some zeros in the dividend to the right of the last digit.)
5. Place the decimal point in the quotient directly above the caret in the dividend
6. Divide as with whole numbers

INFORMATION SHEET

7. Check by multiplying the quotient and the divisor

EXAMPLES:

$$\begin{array}{r} 0\,0.5 \\ 0.5_{\wedge}\overline{)0.2_{\wedge}5} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.5 \\ \times\ 0.5 \\ \hline 0.25 \end{array}$$

$$\begin{array}{r} 5. \\ 0.05_{\wedge}\overline{)0.25_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.05 \\ \times\ 05 \\ \hline 0.25 \end{array}$$

$$0.005\,\overline{)0.25} \quad \text{becomes} \quad \begin{array}{r} 50. \\ 0.005_{\wedge}\overline{)0.250_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.005 \\ \times\ 50 \\ \hline 0.250 \end{array}$$

B. Dividing a whole number by a decimal

1. Place a decimal point in the dividend at the right side of the number
2. Count the number of digits to the right of the decimal point in the divisor
3. Place a caret ($\wedge$) at the end of the number
4. Write as many zeros after the decimal point in the dividend as you counted places in the divisor
5. Place a caret after the last zero
6. Place a decimal point in the quotient directly above the caret in the dividend
7. Divide as with whole numbers

   (NOTE: Zeros may need to be added beyond the caret if the division does not come out even.)

8. Check by multiplying the divisor and quotient

EXAMPLE:

$$0.03\,\overline{)9} \quad \text{becomes} \quad \begin{array}{r} 300. \\ 0.03_{\wedge}\overline{)9.00_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 3\,00 \\ \times\ 0.03 \\ \hline 9.00 \end{array}$$

XX. Converting fractions to decimals and percentages (Transparency #3; Assignment Sheet #17)

A. Fractions as decimals

1. Fractions with denominators of ten or a power of ten

   a. Allow as many decimal places as zeros in the denominator

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b. Place a decimal point in front of the numerator and leave off the denominator

(NOTE: Zeros may be needed as *place holders.*)

EXAMPLES: $^{1}/_{10} = 0.1$; $^{3}/_{100} = 0.03$; $^{79}/_{100} = 0.79$

c. Write mixed numbers with the whole number to the left of the decimal point

EXAMPLES: $1\,^{1}/_{10} = 1.1$

$3\,^{7}/_{100} = 3.07$

2. Any fraction — Divide the numerator by the denominator

EXAMPLE: $\frac{5}{8}$

$$\begin{array}{r} 0.625 \\ 8\,\overline{)\,5.000} \\ \underline{4\,8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

B. Fractions as percentages

(NOTE: *Percent* means that a number is a fraction of 100.)

1. Convert the fractions to decimal form
2. Move the decimal point two places to the right
3. Place the percent symbol (%) after the number

EXAMPLE: $\frac{7}{33}$

$$\begin{array}{r} 0.2121 \\ 33\,\overline{)\,7.0000} \\ \underline{6\,6} \\ 40 \\ \underline{33} \\ 70 \\ \underline{66} \\ 40 \\ \underline{33} \\ 7 \end{array}$$

$0.2121 = 21.21\%$

XXI. Converting decimals to fractions and percentages (Transparency #3; Assignment Sheet #18)

A. Decimals as fractions

1. Write the digits to the left of the decimal point as the whole-number portion of a mixed number

INFORMATION SHEET

2. Count the number of places to the right of the decimal point
3. Write the denominator as a 1 followed by the same number of zeros as there are places to the right of the decimal point
4. Write the digits to the right of the decimal point as the numerator

   (NOTE: Remove the decimal point.)
5. Reduce fraction to lowest terms

EXAMPLES: $62.003 = 62\,{}^{3}/_{1000}$

$0.75 = {}^{75}/_{100}$

$= {}^{3}/_{4}$

B. Decimals as percentages

1. Move the decimal point two places to the right
2. Add the percent symbol (%)

EXAMPLE: 0.375 = 37.5%

XXII. Converting percentages to fractions and decimals (Assignment Sheet #19)

A. Percentages as fractions

1. Drop the percent symbol (%)
2. Place the number over 100

   (NOTE: Reduce to lowest terms.)

   EXAMPLES: $38\% = \frac{38}{100}$

   $= \frac{19}{50}$

   $33\,{}^{1}/_{3}\% = \frac{33\,{}^{1}/_{3}}{100}$

   $= \frac{{}^{100}/_{3}}{100}$

   $= \frac{1}{3}$

B. Percentages as decimals

1. Drop the percent symbol (%)
2. Move the decimal point two places to the left

   EXAMPLES: 74% = 0.74

   $33\,{}^{1}/_{3}\% = 0.33$

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XXIII. Solving percentage problems (Assignment Sheets #20 and #21)

A. Write the unknown as "X"

(NOTE: The unknown may be the percent, the part, or the whole.)

B. Write all percentages as a fraction of 100

C. Make a fraction by placing the part over the whole amount

D. Write the two fractions with an equal sign between them

E. Multiply the numerator of the left fraction by the denominator of the right fraction; then do the opposite by multiplying the numerator of the right fraction by the denominator of the left fraction; place an equal sign between the two products

(NOTE: The process described in *E* is known as *cross multiplying*.)

F. Solve the resulting equation

EXAMPLES: 16 (part) is what percent of 80 (whole)?

$$\frac{16}{80} = \frac{X}{100}$$

$80X = 1600$ (Divide 80 into 1600)

$X = 20\%$

5% of 97.3 is what number?

$$\frac{5}{100} = \frac{X}{97.3}$$

$100X = 486.5$ (Divide 100 into 486.5 or move the decimal point two places to the left)

$X = 4.865$

26 is 40% of what number?

$$\frac{26}{X} = \frac{40}{100}$$

$40X = 2600$ (Divide 40 into 2600)

$X = 65$

INFORMATION SHEET

XXIV. Terms associated with geometric figures

A. Geometric figures — Shapes formed by straight or curved lines

B. Perimeter — Outer limits of area

C. Linear — Relating to a straight line or length

D. Modular — Based on a nominal 4-inch spacing

E. Area — Measure of a flat surface expressed in square units such as square feet

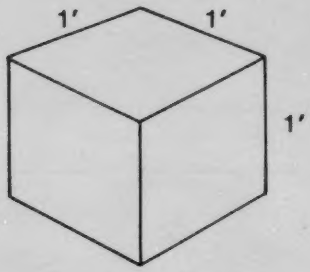
F. Volume — Space occupied by a body having length, height, and width; expressed in cubic units

G. Cubic unit — Unit with three dimensions including length, width, and height

H. Cubic foot — Volume that is 1 foot long, 1 foot wide, and 1 foot high (Figure 2)

EXAMPLE:

FIGURE 2



I. Nominal size — Theoretical size that may vary from actual size

(NOTE: In brickwork nominal size is the size of the brick plus the mortar joint.)

J. Parallel — Extending in the same direction, an equal distance apart and never meeting (Figure 3)

EXAMPLE:

FIGURE 3

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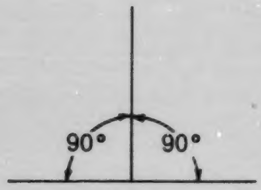
K. Perpendicular — Line or surface at right angle to another line or surface (Figure 4)

EXAMPLE:

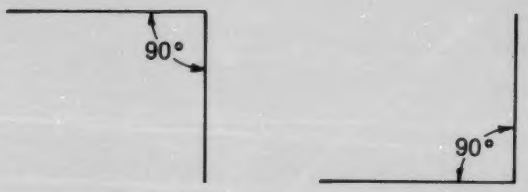
FIGURE 4



L. Right angle — Angle formed by two lines perpendicular to each other (Figure 5)

EXAMPLE:

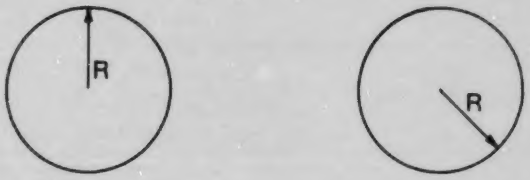
FIGURE 5



M. Radius — Line from center of a circle to any point on the circle (Figure 6)

EXAMPLE:

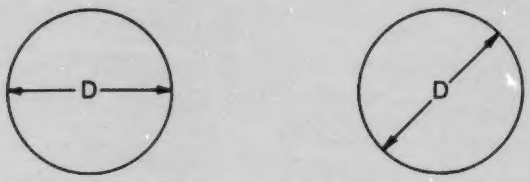
FIGURE 6



N. Diameter — Distance between outer edges of circle through the center point (Figure 7)

EXAMPLE:

FIGURE 7



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O. Circumference — Distance around outer edge of a circle

P. Pi (π) — Greek letter used to represent the ratio of circumference of a circle to its diameter; approximately 3.14

XXV. Types of geometric figures

A. Square — Figure having four sides of equal length and four right angles (Figure 8)

EXAMPLE:

FIGURE 8

B. Rectangle — Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles (Figure 9)

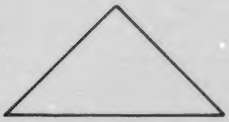
EXAMPLE:

FIGURE 9

C. Triangle — Figure having three sides and three angles (Figure 10)

EXAMPLE:

FIGURE 10



INFORMATION SHEET

D. Circle — Flat, round figure formed by one curved line; all points of the curved line are of equal distance from the center point (Figure 11)

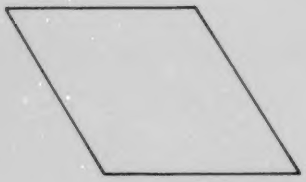
EXAMPLE:

FIGURE 11

E. Rhombus — Figure having four sides of equal length and no right angles (Figure 12)

EXAMPLE:

FIGURE 12



F. Parallelogram — Four-sided figure with two parallel ends of equal length and two parallel sides of equal length (Figure 13)

(NOTE: A square, a rectangle, and a rhombus are also parallelograms.)

EXAMPLE:

FIGURE 13

G. Trapezoid — Four-sided figure with only one pair of opposite sides parallel (Figure 14)

EXAMPLE:

FIGURE 14

XXVI. Units of measure

A. Inch (") — Distance equal to 1/12 foot or 1/36 yard

B. Foot (′) — Distance equal to 12 inches or 1/3 yard

C. Yard — Distance equal to 3 feet or 36 inches

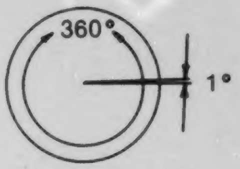
D. Rod — Distance equal to 16 1/2 feet

E. Mile — Distance equal to 5280 feet

F. Degree (°) — Unit of measure for angles (Figure 15)

EXAMPLE:

FIGURE 15



XXVII. Formulas for calculating areas of geometric figures (Transparency #1; Assignment Sheet #22)

(NOTE: Area is always labeled in square units of measure.)

A. Square (Figure 16)

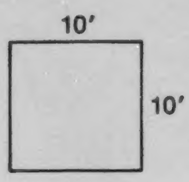
Area = Length × Width
A = LW

EXAMPLE: A = LW

A = 10′ × 10′

A = 100 square feet

FIGURE 16



INFORMATION SHEET

B. Rectangle (Figure 17)

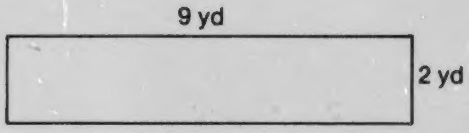
Area = Length × Width
$A = LW$

EXAMPLE: $A = LW$

$A = 9 \text{ yd} \times 2 \text{ yd}$

A = 18 square yards

FIGURE 17



C. Circle (Figure 18)

Area = $\pi \times r^2$ (Radius × Radius)

$\pi = 3.14 \quad \frac{\text{Circumference [c]}}{\text{Diameter [d]}}$

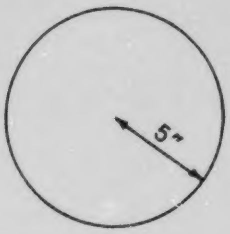
$A = \pi r^2$

EXAMPLE: $A = \pi r^2$

$A = 3.14 \times (5'' \times 5'')$

A = 78.50 square inches

FIGURE 18



D. Triangle (Figure 19)

Area = ½ Base × Height
$A = \frac{1}{2} BH$

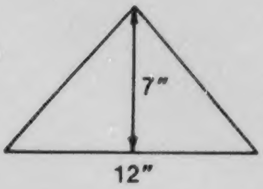
EXAMPLE: $A = \frac{1}{2} BH$

$A = (\frac{1}{2} \times 12'') \times 7''$

$A = 6'' \times 7''$

A = 42 square inches

FIGURE 19



E. Parallelogram (Figure 20)

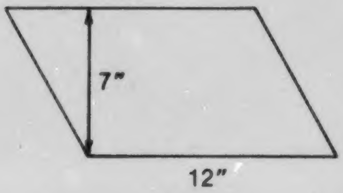
Area = Base × Height
$A = BH$

EXAMPLE: $A = BH$

$A = 12'' \times 7''$

A = 84 square inches

FIGURE 20



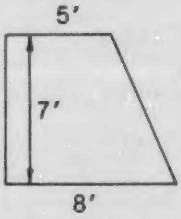
INFORMATION SHEET

F. Trapezoid (Figure 21)

Area = $\frac{1}{2}$ Height × (Length of One Base + Length of Other Base)

$A = \frac{1}{2} H (B_1 + B_2)$

FIGURE 21



EXAMPLE: $A = \frac{1}{2} H (B_1 + B_2)$

$$A = \frac{1}{2} \times 7' \times (8' + 5')$$

$$A = \frac{7}{2} \times 13$$

$$A = \frac{7}{2} \times \frac{13}{1}$$

$$A = \frac{91}{2} \text{ or } 45\frac{1}{2} \text{ square feet}$$

XXVIII. Calculating volume of solid figures (Assignment Sheets #23 — #25)

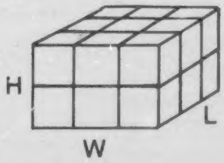
(NOTE: Volume is always labeled in cubic units of measure.)

A. Counting

Cubic Units = Number of Cubes in Layer × Number of Layers

EXAMPLE: 9 Cubes in Layer × 2 Layers = 18 Cubic Units (Figure 22)

FIGURE 22



B. Formula

Volume = Length × Width × Height
V = LWH

EXAMPLES: 1.

$$L = 3'$$
$$W = \frac{1}{2}'$$
$$H = 1\frac{1}{2}'$$
$$V = LWH$$
$$= 3 \times \frac{1}{2} \times \frac{3}{2}$$
$$= \frac{9}{4} \text{ or } 2\frac{1}{4} \text{ cubic feet}$$

INFORMATION SHEET

2. $L = 10'$
$W = 8'$
$H = 3'$

$V = LWH$

$= 10 \times 8 \times 3$

$= 240$ cubic feet

C. Estimating cubic yards

$$\frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27} = \text{Cubic Yards}$$

(NOTE: Given measurements are usually in feet and inches, which have to be broken down by using fractions or decimals.)

EXAMPLES: 1. Fractions

$$\frac{30' \times 60' \times 4''}{27} = \frac{30' \times 60' \times {}^{1}/_{3}'}{27}$$

$$= 22.22 \text{ cubic yards}$$

2. Decimals

$$\frac{30' \times 60' \times 0.33'}{27} = \frac{594}{27}$$

$$= 22 \text{ cubic yards}$$

XXIX. Ratio and proportion (Transparency #2; Assignment Sheet #26)

A. Ratio indicates parts of material per mix

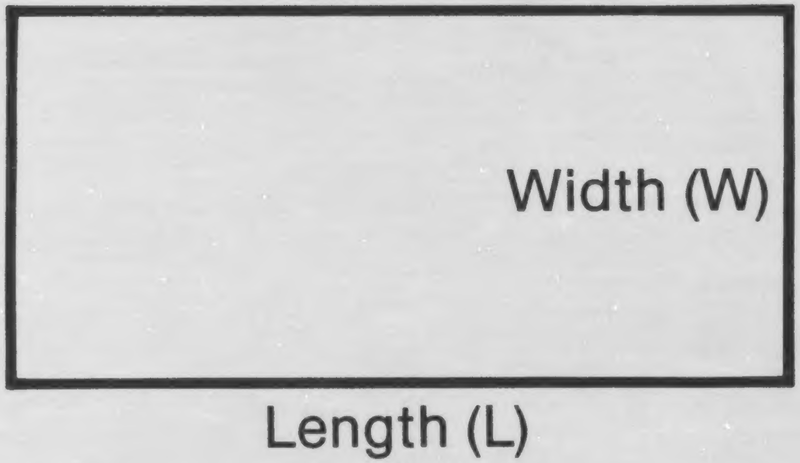
EXAMPLE: 1:1:3 ratio means 1 part portland cement, 1 part hydrated lime, and 3 parts sand in a mixture of mortar.

B. Proportion indicates that ratio is the same but quantity may differ

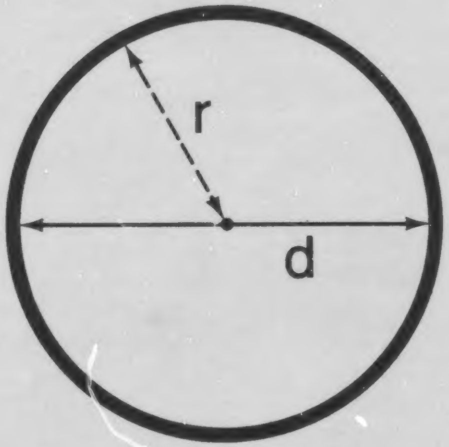
EXAMPLE: 1:1:3 is the same proportion as 0.5:0.5:1.5, or 2:2:6, of same mix but in different volumes.

Area

PARALLELOGRAM


Width (W)
Length (L)

CIRCLE



$\pi = 3.1416$

Length x Width = Area

$$\text{Radius } (r) = \frac{\text{Diameter } (d)}{2}$$

$$\pi r^2 = \text{Area of Circle}$$

Ratio and Proportion

1:1:3	Ratio of Cement, Lime, and Sand in Mortar Mix
0.50:0.50:1.5	Proportion of Ratio 1:1:3 Cut in Half

Decimal Equivalents

		1/64	.015625
	1/32		.03125
		3/64	.046875
	1/16		.0625
		5/64	.078125
	3/32		.09375
		7/64	.109375
1/8			.125
		9/64	.140625
	5/32		.15625
		11/64	.171875
	3/16		.1875
		13/64	.203125
	7/32		.21875
		15/64	.234375
1/4			.25
		17/64	.265625
	9/32		.28125
		19/64	.296875
	5/16		.3125
		21/64	.328125
	11/32		.34375
		23/64	.359375
3/8			.375
		25/64	.390625
	13/32		.40625
		27/64	.421875
	7/16		.4375
		29/64	.453125
	15/32		.46875
		31/64	.484375
1/2			.5
		33/64	.515625
	17/32		.53125
		35/64	.546875
	9/16		.5625
		37/64	.578125
	19/32		.59375
		39/64	.609375
5/8			.625
		41/64	.640625
	21/32		.65625
		43/64	.671875
	11/16		.6875
		45/64	.703125
	23/32		.71875
		47/64	.734375
3/4			.75
		49/64	.765625
	25/32		.78125
		51/64	.796875
	13/16		.8125
		53/64	.828125
	27/32		.84375
		55/64	.859375
7/8			.875
		57/64	.890625
	29/32		.90625
		59/64	.921875
	15/16		.9375
		61/64	.953125
	31/32		.96875
		63/64	.984375
1			1.

BASIC MATH
UNIT I

ASSIGNMENT SHEET #1 — SOLVE ADDITION PROBLEMS

NAME ______________________________ SCORE ______________

Like most people, you probably use addition every day. For example, today you probably added coins together to pay for sodas and snacks. Every time you add, you use basic addition facts. The numbers you add together are called *addends.* The answer in an addition problem is called the *sum* or *total.* The following exercises will form part of your math background and serve as a basis for completing other exercises and/or problems.

EXAMPLES:

$$\begin{array}{r} 5 \\ +\ 10 \\ \hline 15 \end{array} \qquad \begin{array}{r} 1 \leftarrow \text{Carried number} \\ 67 \\ +\ 25 \\ \hline 92 \end{array}$$

$$\begin{array}{r} 11 \leftarrow \text{Carried numbers} \\ 539 \\ 333 \\ +\ 432 \\ \hline 1304 \end{array}$$

2 + 3 + 9 = 14
Record the 4 and carry the 1
The carried 1 + 3 + 3 + 3 = 10
Record the 0 and carry the 1
The carried 1 + 4 + 3 + 5 = 13
Record the 13.

A. Solve each of the following problems for the sum or total. Show your work.

1. $\begin{array}{r} 2 \\ +\ 9 \\ \hline \end{array}$
2. $\begin{array}{r} 8 \\ +\ 8 \\ \hline \end{array}$
3. $\begin{array}{r} 7 \\ +\ 6 \\ \hline \end{array}$
4. $\begin{array}{r} 15 \\ +\ 8 \\ \hline \end{array}$
5. $\begin{array}{r} 81 \\ +\ 27 \\ \hline \end{array}$
6. $\begin{array}{r} 7 \\ 38 \\ +\ 43 \\ \hline \end{array}$
7. $\begin{array}{r} 55 \\ 88 \\ +\ 99 \\ \hline \end{array}$
8. $\begin{array}{r} 341 \\ 428 \\ +\ 769 \\ \hline \end{array}$
9. $\begin{array}{r} 472 \\ 564 \\ +\ 881 \\ \hline \end{array}$
10. $\begin{array}{r} 9876 \\ 5432 \\ +\ 1122 \\ \hline \end{array}$

ASSIGNMENT SHEET #1

B. If a bricklayer laid 332 bricks on one wall, 572 on another, and 278 on another, how many bricks were laid? Show your work.

Total = ________________ bricks

C. A bricklayer purchased the following number of bags of cement at different dates: 256 bags, 62 bags, 42 bags, 575 bags, and 1242 bags. How many bags of cement were purchased? Show your work.

Total = ________________ bags

D. A contractor paid $480 for brick, $13 for lime, $81 for cement, and $35 for sand. What was the total cost of materials? Show your work.

Total Cost = $________________

E. If it takes 1135 concrete blocks for one wall, 1225 blocks for a second wall, 1217 blocks for another wall, 1105 blocks for another wall, and 7421 blocks for the partition walls, what would be the total number of blocks needed for the job? Show your work.

Total = ________________ concrete blocks

BASIC MATH
UNIT I

ASSIGNMENT SHEET #2 — SOLVE SUBTRACTION PROBLEMS

NAME ______________________________ SCORE ____________

Addition is the first fundamental operation in mathematics. Subtraction, the opposite of addition, is the process of finding the difference between two numbers. It is the second fundamental operation. You can check the accuracy of the answer obtained in a subtraction problem by simply adding the difference to the subtrahend. The sum of these two numbers must equal the minuend if the answer is correct.

EXAMPLES: $\begin{array}{r} 12 \\ -\ 7 \\ \hline 5 \end{array}$ Check $\begin{array}{r} 7 \\ +\ 5 \\ \hline 12 \end{array}$ $\begin{array}{r} 57 \\ -\ 35 \\ \hline 22 \end{array}$

Subtract 5 from 7 and record the 2
Subtract 3 from 5 and record the 2
Answer or difference is 22
Add 22 to 35 = 57
Answer is correct

Solve each of the following problems to find the difference; check your answers by adding the difference to the subtrahend. Show your work.

A.

1. $\begin{array}{r} 7 \\ -\ 5 \\ \hline \end{array}$
2. $\begin{array}{r} 15 \\ -\ 8 \\ \hline \end{array}$
3. $\begin{array}{r} 75 \\ -\ 22 \\ \hline \end{array}$
4. $\begin{array}{r} 453 \\ -\ 47 \\ \hline \end{array}$
5. $\begin{array}{r} 742 \\ -\ 318 \\ \hline \end{array}$
6. $\begin{array}{r} 9817 \\ -\ 698 \\ \hline \end{array}$
7. $\begin{array}{r} 1420 \\ -\ 245 \\ \hline \end{array}$
8. $\begin{array}{r} 3459 \\ -\ 1649 \\ \hline \end{array}$
9. $\begin{array}{r} 55722 \\ -\ 4271 \\ \hline \end{array}$
10. $\begin{array}{r} 98679 \\ -\ 8957 \\ \hline \end{array}$

B. If a wall takes 172 blocks and you have 46, how many more blocks would you need for the job?

Difference = ________________ blocks

ASSIGNMENT SHEET #2

C. If you have 542 bricks and it takes 1702 bricks to complete a wall, how many more bricks will you need?

Difference = ________________ bricks

D. On a remodeling job you have 470 bricks to remove and use again; you have 1640 in your warehouse, and it takes 6520 to do the job. How many more bricks will you need?

Difference = ________________ bricks

E. A bricklayer purchased 48,000 bricks. Of these he used 4850 on one job, 12,720 on another job, and 16,285 on a third job. How many bricks did he have left?

Difference = ________________ bricks

BASIC MATH
UNIT I

ASSIGNMENT SHEET #3 — SOLVE MULTIPLICATION PROBLEMS

NAME ______________________________ SCORE ____________

Multiplication is the third basic operation in mathematics. It is a shortcut method of adding. For example, if you correctly add twelve 12s, the result will be 144, the same as 12 multiplied by 12. Some multiplication problems involve carrying. You may write down the carried numerals, or simply remember them. Use the method that works best for you. When multiplying by numbers that contain two or more digits, you must be careful to align the partial products properly. The right-hand digit of each partial product is written directly below the multiplying digit. This causes the partial products to be properly aligned so that tens will be added to tens, hundreds to hundreds, and so on.

EXAMPLES:

$7 \times 8 = 56$

$$\begin{array}{r} 8 \\ \times 7 \\ \hline 56 \end{array} \qquad \begin{array}{rl} 1 & \leftarrow \text{Carried number} \\ 53 & \\ \times 4 & \\ \hline 212 & \end{array} \qquad \begin{array}{rl} 11 & \leftarrow \text{Carried numbers} \\ 756 & \\ \times 312 & \\ \hline 1512 & \text{First partial product} \\ 756 & \text{Second partial product} \\ 2268 & \text{Third partial product} \\ \hline 235872 & \text{Product} \end{array}$$

Solve each of the following multiplication problems.

A.

1. $\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$
2. $\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$
3. $\begin{array}{r} 54 \\ \times 6 \\ \hline \end{array}$
4. $\begin{array}{r} 721 \\ \times 4 \\ \hline \end{array}$
5. $\begin{array}{r} 1682 \\ \times 5 \\ \hline \end{array}$
6. $\begin{array}{r} 78 \\ \times 26 \\ \hline \end{array}$
7. $\begin{array}{r} 453 \\ \times 47 \\ \hline \end{array}$
8. $\begin{array}{r} 314 \\ \times 527 \\ \hline \end{array}$
9. $\begin{array}{r} 2143 \\ \times 235 \\ \hline \end{array}$
10. $\begin{array}{r} 4123 \\ \times 1324 \\ \hline \end{array}$

B. If one load of brick weighs 9769 pounds, how much would 7 loads weigh? Show your work.

Product = ______________ pounds

ASSIGNMENT SHEET #3

C. If a bricklayer can lay an average of 170 bricks in an hour, how many bricks should he lay in 48 hours? Show your work.

Product = ________________ bricks

D. Six bricklayers lay an average of 950 bricks per person per day. What will be their average for three days' work? Show your work.

Product = ________________ bricks

E. Figure the total amount of John Potts' brick contractor's weekly payroll for 12 bricklayers who work 30 hours each and receive $18 per hour. Show your work.

Product = $________________ weekly payroll

BASIC MATH
UNIT I

ASSIGNMENT SHEET #4 — SOLVE DIVISION PROBLEMS

NAME ____ SCORE ________________

Division is the fourth and last basic operation in mathematics. Multiplication puts together — division takes apart. Division is the reverse of multiplication. *Long division* is the name used for division by numbers that cannot readily be used as simple divisors. The individual products and remainders, because of their length, are written.

EXAMPLES: $972 \div 3 = 324$ $5678 \div 51 = 111$, R (remainder) 17

$$\begin{array}{r}
324 \\
3\overline{)972} \\
\underline{9} \\
7 \\
\underline{6} \\
12 \\
\underline{12} \\
0
\end{array}
\qquad\qquad
\begin{array}{rl}
111 & \text{Quotient} \\
51\overline{)5678} & \\
\underline{51} & \\
57 & \\
\underline{51} & \\
68 & \\
\underline{51} & \\
17 & \longleftarrow \text{Remainder}
\end{array}$$

Solve each of the following division problems to find the quotient.

(NOTE: Check your answers by multiplying the divisor by the quotient.)

A. 1. $2\overline{)8}$ 2. $6\overline{)48}$ 3. $9\overline{)819}$ 4. $4\overline{)1248}$ 5. $13\overline{)39}$

6. $66\overline{)198}$ 7. $84\overline{)5212}$ 8. $124\overline{)345}$ 9. $464\overline{)829}$ 10. $746\overline{)2872}$

B. Four bricklayers working together laid 4140 bricks in one day. What was the average number of bricks laid by each bricklayer for that day? Show your work.

Quotient = ________________ bricks laid by each bricklayer

ASSIGNMENT SHEET #4

C. Bill Parnell purchased a carload of 48,000 bricks from the kiln. If the total cost was $864, what was the cost per thousand? Show your work.

Quotient = ________________ cost per thousand bricks

D. John Potts gave a price of $400 for labor of laying 12,000 bricks on a building. What was the labor cost per thousand bricks? Show your work.

Quotient = ________________ cost per thousand bricks

E. If a brick wall is 4 inches thick (one brick), and it takes 7 bricks with mortar joints to lay up one square foot of wall surface, how many square feet can be laid up with 763 bricks? Show your work.

Quotient = ________________ square feet

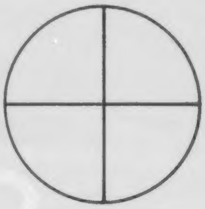
BLC - 49-B

BASIC MATH
UNIT I

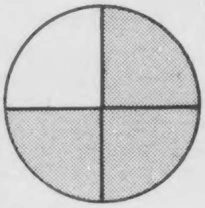
ASSIGNMENT SHEET #5 — DETERMINE PARTS OF FRACTIONS

NAME ________________________________ SCORE ____________

When something is divided into parts that are all the same size, or equal size, it is divided into fractional parts. For example, the circle below is divided into four fractional parts.



To talk about fractional parts, you use fractions. For example, one of the four parts of the circle is unshaded, or $^{1}/_{4}$ of the circle is unshaded; three of the four parts of the circle are shaded, or $^{3}/_{4}$ of the circle is shaded.



In the fraction $^{3}/_{4}$, the 4 is called the *denominator.* It shows the number of equal parts into which the circle is divided. The 3 is called the *numerator.* It shows the number of parts that are used.

PART I

A. In the following fractions, identify the numerator and denominator of each.

1. In the fraction $^{5}/_{7}$, the numerator is ________ and the denominator is ________.
2. In the fraction $^{8}/_{18}$, 8 is the ______________________ and 18 is the ___________________.
3. In the fraction $^{1}/_{3}$, what is the numerator? ________ denominator? ________

ASSIGNMENT SHEET #5

B. Write fractions that fit the following statements.

1. A fraction with a denominator of 17 and numerator of 10 ________________

2. A fraction with a numerator of 16 and a denominator of 37 ________________

C. A man cuts a piece of sheet metal into 8 equal pieces but destroys 1 of the 8 pieces.

1. What fractional part of the sheet metal did the man destroy? ______________

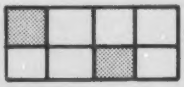
2. Which number represents the numerator? ______________________________

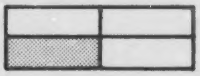
3. Which number represents the denominator? ____________________________

PART II

A. Match the shaded portions of the figures to their correct fractions. There are more figures than there are fractions.

______ 1. 4/8
______ 2. 2/2
______ 3. 6/16
______ 4. 3/7
______ 5. 5/5
______ 6. 1/2
______ 7. 2/7
______ 8. 5/6
______ 9. 1/4
______10. 2/3
______11. 7/8
______12. 3/5
______13. 2/8
______14. 3/3
______15. 1/5


a.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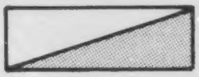
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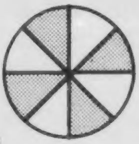
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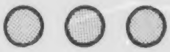
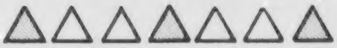

e.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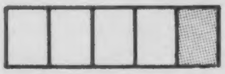
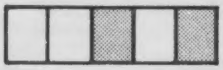
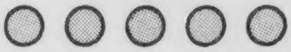

g.


h.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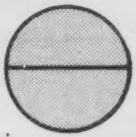
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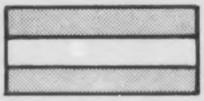
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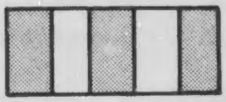
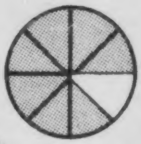

l.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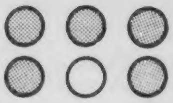
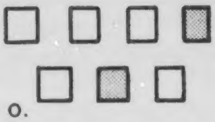

n.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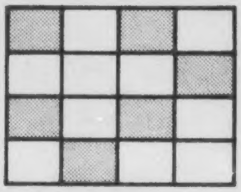
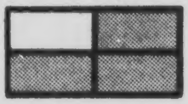

p.

ASSIGNMENT SHEET #5

B. Draw a suitable figure to represent each of the following fractions.

EXAMPLE: $^3/_4$



1. $^1/_2$

2. $^3/_4$

3. $^2/_3$

4. $^1/_4$

5. $^7/_8$

ASSIGNMENT SHEET #5

6. $^{5}/_{16}$

7. $^{2}/_{7}$

8. $^{3}/_{3}$

9. $^{3}/_{8}$

10. $^{13}/_{16}$

BASIC MATH
UNIT I

ASSIGNMENT SHEET #6 — CONVERT FRACTIONS

NAME ______________________________ SCORE ______________

A fraction like $^3/_4$ is called a *proper fraction* because the numerator (top number) is smaller than the denominator (bottom number). Some examples of proper fractions are $^2/_3$, $^1/_5$, and $^7/_8$.

When the numerator of a fraction is the same as, or larger than, the denominator, the fraction is called an *improper fraction.* Some examples of improper fractions are $^4/_4$, $^5/_3$, $^9/_4$, and $^{10}/_8$.

Numbers such as 2 $^1/_2$, 5 $^3/_4$, and 6 $^2/_5$ are called *mixed numbers.* They are made up of a whole number and a fraction.

PART I

A. Distinguish among the following types of fractions. Write a "P" in the blanks before proper fractions, an "I" in the blanks before improper fractions, and an "M" in the blanks before mixed numbers.

______ 1. $^1/_2$

______ 2. $^7/_8$

______ 3. $^{16}/_2$

______ 4. 3 $^1/_8$

______ 5. $^1/_4$

______ 6. $^1/_1$

______ 7. $^7/_3$

______ 8. 8 $^1/_3$

______ 9. $^4/_4$

______10. 9 $^2/_3$

______11. 5 $^1/_2$

______12. $^9/_8$

______13. $^9/_9$

______14. $^1/_7$

______15. 16 $^3/_4$

B. Use the given denominators and fill in numerators to complete the following problems.

1. Make proper fractions:

   a. $\frac{\quad}{8}$

   b. $\frac{\quad}{10}$

   c. $\frac{\quad}{7}$

   d. $\frac{\quad}{2}$

   e. $\frac{\quad}{30}$

ASSIGNMENT SHEET #6

2. Make improper fractions:

a. $\frac{\_\_}{3}$

b. $\frac{\_\_}{5}$

c. $\frac{\_\_}{6}$

d. $\frac{\_\_}{9}$

e. $\frac{\_\_}{4}$

PART II

A. Convert each of the following mixed numbers to improper fractions. (Do not reduce answers to lowest terms at this time.)

1. $3\,{}^{1}/_{4}$ = ______
2. $4\,{}^{1}/_{2}$ = ______
3. $7\,{}^{1}/_{3}$ = ______
4. $8\,{}^{1}/_{2}$ = ______
5. $6\,{}^{2}/_{3}$ = ______
6. $5\,{}^{1}/_{5}$ = ______
7. $4\,{}^{2}/_{3}$ = ______
8. $8\,{}^{1}/_{7}$ = ______
9. $9\,{}^{1}/_{5}$ = ______
10. $16\,{}^{2}/_{3}$ = ______
11. $2\,{}^{1}/_{2}$ = ______
12. $3\,{}^{2}/_{4}$ = ______
13. $7\,{}^{3}/_{4}$ = ______
14. $9\,{}^{2}/_{3}$ = ______
15. $5\,{}^{2}/_{3}$ = ______
16. $6\,{}^{1}/_{8}$ = ______
17. $3\,{}^{3}/_{4}$ = ______
18. $6\,{}^{4}/_{5}$ = ______
19. $4\,{}^{1}/_{3}$ = ______
20. $1\,{}^{4}/_{5}$ = ______

ASSIGNMENT SHEET #6

B. Convert each of the following improper fractions to mixed numbers. (Do not reduce answers to lowest terms at this time.)

1. $^{16}/_{5}$ = ______
2. $^{12}/_{5}$ = ______
3. $^{17}/_{3}$ = ______
4. $^{8}/_{3}$ = ______
5. $^{19}/_{13}$ = ______
6. $^{8}/_{7}$ = ______
7. $^{75}/_{32}$ = ______
8. $^{24}/_{17}$ = ______
9. $^{9}/_{2}$ = ______
10. $^{5}/_{3}$ = ______
11. $^{7}/_{2}$ = ______
12. $^{9}/_{4}$ = ______
13. $^{17}/_{16}$ = ______
14. $^{11}/_{5}$ = ______
15. $^{13}/_{9}$ = ______
16. $^{7}/_{4}$ = ______
17. $^{9}/_{8}$ = ______
18. $^{4}/_{3}$ = ______
19. $^{15}/_{4}$ = ______
20. $^{17}/_{7}$ = ______

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BASIC MATH
UNIT I

ASSIGNMENT SHEET #7 — REDUCE FRACTIONS TO LOWEST TERMS

NAME ________________________________ SCORE ____________

Fractions are "reduced" to their lowest terms so that they are more readily understood or recognized. For example, $^{1}/_{2}$ is more easily recognized than $^{16}/_{32}$.

To reduce a fraction to lowest terms, divide the numerator and the denominator by all divisors that are common to both.

EXAMPLES:

$$\frac{18 \div 2}{24 \div 2} = \frac{9}{12}$$

$$\frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

Reduce the following fractions to lowest terms.

A. $^{3}/_{9}$ = ______

B. $^{8}/_{24}$ = ______

C. $^{10}/_{15}$ = ______

D. $^{15}/_{25}$ = ______

E. $^{12}/_{48}$ = ______

F. $^{9}/_{24}$ = ______

G. $^{5}/_{7}$ = ______

H. $^{2}/_{4}$ = ______

I. $^{9}/_{12}$ = ______

J. $^{50}/_{100}$ = ______

K. $^{5}/_{5}$ = ______

L. $^{8}/_{12}$ = ______

M. $^{7}/_{21}$ = ______

N. $^{4}/_{8}$ = ______

O. $^{10}/_{12}$ = ______

P. $^{26}/_{52}$ = ______

Q. $^{6}/_{9}$ = ______

R. $^{13}/_{39}$ = ______

S. $^{9}/_{9}$ = ______

T. $^{12}/_{16}$ = ______

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BASIC MATH
UNIT I

ASSIGNMENT SHEET #8 — FIND COMMON DENOMINATORS

NAME ____________________________________ SCORE ______________

To add fractions with different denominators, first change the fractions to equivalent fractions with a common denominator.

To change a fraction to its equivalent, multiply the denominator of the given fraction by the number that will give the desired denominator; then multiply the numerator of the fraction by the same multiplier.

EXAMPLE: $\frac{1}{2} = \frac{\quad}{8}$ $\frac{1 \times 4}{2 \times 4} = \frac{4}{8}$ $\frac{1}{2} = \frac{4}{8}$

To change a fraction to its equivalent in a lower denomination, proceed in like manner, but divide, instead of multiply, both the denominator and the numerator by the same number.

EXAMPLE: $\frac{12}{16} = \frac{\quad}{4}$ $\frac{12 \div 4}{16 \div 4} = \frac{3}{4}$ $\frac{12}{16} = \frac{3}{4}$

PART I

Convert each of the following fractions to the indicated equivalent fractions.

A. $\frac{1}{2} = \frac{\quad}{12}$
B. $\frac{1}{4} = \frac{\quad}{32}$
C. $\frac{12}{16} = \frac{\quad}{4}$
D. $\frac{15}{48} = \frac{\quad}{16}$
E. $\frac{2}{3} = \frac{\quad}{12}$
F. $\frac{5}{8} = \frac{\quad}{32}$
G. $\frac{18}{24} = \frac{\quad}{4}$
H. $\frac{25}{80} = \frac{\quad}{16}$
I. $\frac{3}{4} = \frac{\quad}{12}$
J. $\frac{7}{8} = \frac{\quad}{32}$
K. $\frac{24}{32} = \frac{\quad}{4}$
L. $\frac{28}{64} = \frac{\quad}{16}$
M. $\frac{5}{6} = \frac{\quad}{12}$
N. $\frac{9}{16} = \frac{\quad}{32}$
O. $\frac{42}{56} = \frac{\quad}{4}$
P. $\frac{18}{32} = \frac{\quad}{16}$

PART II

Fractions that have the same denominator are said to have a common denominator.

EXAMPLE: Find common denominator of $^{5}/_{6}$ and $^{3}/_{8}$.

Common denominator of $^{5}/_{6}$ and $^{3}/_{8}$ is a common multiple of 6 and 8.

24 is a common multiple of 6 and 8.
It is a common denominator of $^{5}/_{6}$ and $^{3}/_{8}$.
24 is the lowest common multiple of 6 and 8.
24 is the lowest common denominator of $^{5}/_{6}$ and $^{3}/_{8}$.

ASSIGNMENT SHEET #8

Find the lowest common denominator for each set of fractions.

A. $^{7}/_{8}$ $^{5}/_{12}$ $^{3}/_{16}$ $^{17}/_{24}$ = ______________________

B. $^{3}/_{5}$ $^{5}/_{6}$ $^{9}/_{10}$ $^{4}/_{15}$ = ______________________

C. $^{1}/_{2}$ $^{5}/_{12}$ $^{2}/_{3}$ $^{3}/_{4}$ = ______________________

D. $^{3}/_{4}$ $^{5}/_{6}$ $^{12}/_{24}$ $^{40}/_{36}$ = ______________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #9 — ADD FRACTIONS

NAME ______________________________ SCORE ____________

To add fractions with different denominators, change them to equivalent fractions with common denominators. Add the new numerators and place this sum over the common denominator. If the result is an improper fraction, change it to a mixed number and reduce to lowest terms.

EXAMPLE:

$$\frac{2}{3} + \frac{3}{4} = \frac{8}{12} + \frac{9}{12}$$

$$= \frac{17}{12}$$

$$= 1\frac{5}{12}$$

Find common denominators and add the following fractions. Reduce to lowest terms. Show your work.

A. $^{1}/_{4} + ^{2}/_{3} =$ ______

C. $^{5}/_{9} + ^{4}/_{7} =$ ______

B. $^{4}/_{5} + ^{3}/_{4} =$ ______

D. $^{7}/_{12} + ^{5}/_{8} =$ ______

ASSIGNMENT SHEET #9

E. $\frac{3}{4} + \frac{5}{6} =$ _____

G. $\frac{2}{5} + \frac{4}{9} =$ _____

F. $\frac{5}{8} + \frac{5}{6} =$ _____

H. $\frac{3}{5} + \frac{2}{3} =$ _____

BASIC MATH
UNIT I

ASSIGNMENT SHEET #10 — SUBTRACT FRACTIONS

NAME ______________________________ SCORE ______________

To subtract fractions with different denominators, change them to equivalent fractions with common denominators. Find the difference between the numerators of the equivalent fractions. Place the difference over the common denominator and, if necessary, reduce the answer to lowest terms.

EXAMPLE:

$$\frac{2}{3} - \frac{1}{4} = \frac{8}{12} - \frac{3}{12}$$

$$= \frac{5}{12}$$

Subtract each of the common fractions given below. Reduce to lowest terms. Show your work.

A. $^{3}/_{4} - ^{2}/_{3} =$ ______

D. $^{5}/_{6} - ^{5}/_{8} =$ ______

B. $^{7}/_{8} - ^{2}/_{3} =$ ______

E. $^{5}/_{9} - ^{3}/_{8} =$ ______

C. $^{4}/_{5} - ^{5}/_{12} =$ ______

F. $^{2}/_{3} - ^{1}/_{2} =$ ______

ASSIGNMENT SHEET #10

G. $4/5 - 3/8 =$ ______

H. $9/10 - 2/3 =$ ______

I. $6/7 - 5/9 =$ ______

J. $1/3 - 5/18 =$ ______

BASIC MATH
UNIT I

ASSIGNMENT SHEET #11 — MULTIPLY FRACTIONS

NAME ______________________________ SCORE ______________

To multiply fractions, multiply the numerators and denominators separately. Write the product of the numerators over the product of the denominators and reduce to lowest terms.

EXAMPLE: $\frac{2}{3} \times \frac{3}{4} = \frac{2 \times 3}{3 \times 4}$

$= \frac{6}{12}$

$= \frac{1}{2}$

Multiply the following fractions. Convert mixed fractions where needed and reduce answers to the lowest terms. Show your work.

A. $\frac{1}{2} \times \frac{3}{4} =$ _____

E. $\frac{7}{8} \times \frac{2}{3} =$ _____

B. $\frac{3}{8} \times \frac{5}{16} =$ _____

F. $1\frac{1}{3} \times 2\frac{1}{4} \times \frac{1}{2} =$ _____

C. $1\frac{1}{2} \times 2\frac{1}{4} =$ _____

G. $\frac{1}{4} \times \frac{1}{3} \times \frac{1}{2} =$ _____

D. $\frac{1}{2} \times 6\frac{1}{2} =$ _____

H. $2\frac{3}{4} \times 6\frac{1}{8} =$ _____

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BASIC MATH
UNIT I

ASSIGNMENT SHEET #12 — DIVIDE FRACTIONS

NAME ______________________ SCORE ____________

The process of dividing fractions involves multiplication. Invert the divisor first, then multiply.

EXAMPLE: $\frac{7}{8} \div \frac{1}{4} = \frac{7}{8} \times \frac{4}{1}$

$= \frac{28}{8}$

$= 3\frac{4}{8}$

$= 3\frac{1}{2}$

Solve the following division problems. Reduce answers to lowest terms. Show your work.

A. $\frac{7}{8} \div \frac{3}{4} =$ _____

B. $\frac{3}{4} \div \frac{2}{1} =$ _____

C. $\frac{5}{6} \div \frac{4}{5} =$ _____

D. $3\frac{1}{2} \div \frac{3}{4} =$ _____

E. $\frac{9}{10} \div \frac{1}{3} =$ _____

F. $7\frac{1}{3} \div \frac{3}{5} =$ _____

G. $\frac{3}{8} \div \frac{1}{2} =$ _____

H. $8 \div \frac{3}{5} =$ _____

I. $12\frac{3}{8} \div 1\frac{1}{2} =$ _____

J. $2\frac{2}{3} \div \frac{1}{16} =$ _____

BASIC MATH
UNIT I

ASSIGNMENT SHEET #13 — SOLVE ADDITION PROBLEMS WITH DECIMALS

NAME ______________________________ SCORE ______________

You can add decimals the same way you add whole numbers. You must be careful, though, to keep all decimal points in a straight line.

Add each column of numbers, carrying when necessary. Place a decimal point in the sum directly under the above decimal points.

EXAMPLES:

$$\begin{array}{r} 0.26 \\ +\ 0.168 \\ \hline 0.428 \end{array} \qquad \begin{array}{r} 4.607 \\ +\ .408 \\ \hline 5.015 \end{array}$$

A. $\begin{array}{r} 0.024 \\ +\ 0.165 \\ \hline \end{array}$

B. $\begin{array}{r} 5.00 \\ +\ 0.99 \\ \hline \end{array}$

C. $\begin{array}{r} 0.5 \\ 0.6 \\ +\ 8.3 \\ \hline \end{array}$

D. $\begin{array}{r} 8.69 \\ 3.07 \\ +\ 17.50 \\ \hline \end{array}$

E. $\begin{array}{r} 1986.45 \\ 312.45 \\ +\ 1000.98 \\ \hline \end{array}$

F. $\begin{array}{r} 0.873 \\ +\ 0.199 \\ \hline \end{array}$

G. $\begin{array}{r} 4.5 \\ +\ 0.008 \\ \hline \end{array}$

H. $\begin{array}{r} 195.7 \\ 83. \\ +\ 9.006 \\ \hline \end{array}$

I. $\begin{array}{r} 4.612 \\ 0.958 \\ +\ 0.885 \\ \hline \end{array}$

J. $\begin{array}{r} 4937.23 \\ 4980.47 \\ 10234.97 \\ +\ 9872.21 \\ \hline \end{array}$

K. $\begin{array}{r} 4.6 \\ +\ 4.62 \\ \hline \end{array}$

L. $\begin{array}{r} 62.14 \\ +\ 8.87 \\ \hline \end{array}$

M. $\begin{array}{r} 21.5 \\ 18.9 \\ +\ 32.8 \\ \hline \end{array}$

N. $\begin{array}{r} 5.29 \\ 4.38 \\ +\ 9.62 \\ \hline \end{array}$

O. $\begin{array}{r} 0.52802 \\ 0.34007 \\ 0.00321 \\ +\ 0.00009 \\ \hline \end{array}$

P. $\begin{array}{r} 0.0003 \\ +\ 0.0099 \\ \hline \end{array}$

Q. $\begin{array}{r} 3.487 \\ +\ 9.645 \\ \hline \end{array}$

R. $\begin{array}{r} 0.0131 \\ 0.1640 \\ +\ 0.2229 \\ \hline \end{array}$

S. $\begin{array}{r} 72.24 \\ 16.38 \\ +\ 92.37 \\ \hline \end{array}$

T. $\begin{array}{r} 15.125 \\ 4.625 \\ 20.125 \\ +\ 16.125 \\ \hline \end{array}$

BASIC MATH
UNIT I

ASSIGNMENT SHEET #14 — SOLVE SUBTRACTION PROBLEMS WITH DECIMALS

NAME ______________________ SCORE ____________

Solving subtraction problems with decimals is the same as solving subtraction problems with whole numbers. You must be careful, though, to keep all decimal points in a straight line.

Rewrite each of these problems in column form. Subtract and check your work. Show your work.

A. 868.87 − 516.89 = ____________

B. 567 − 19.856 = ____________

C. 198 − 56.987 = ____________

D. 567.94 − 59.78 = ____________

ASSIGNMENT SHEET #14

E. $815.23 – $65.98 = ________________

F. $20.03 – $15.88 = ________________

G. 694.7 – 24.3 = ________________

H. 5000 – 892.66 = ________________

I. $15.00 – $12.53 = ________________

J. 219.3 – 0.085 = ________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #15 — SOLVE MULTIPLICATION PROBLEMS WITH DECIMALS

NAME ____________________________ SCORE ____________

Multiplication with decimals is like multiplication with whole numbers. However, with decimals you must be careful where you place the decimal point. The number of decimal places in the product must equal the total number of decimal places in the numbers that you multiplied.

EXAMPLE:

```
  16.11  — 2 decimal places
 × 2.2   — 1 decimal place
 ------
  3 222
 32 22
 ------
 35.442  — 3 decimal places in product
```

Rewrite these numbers in column form and multiply. Locate the decimal point in the product. Show your work.

A. 2.64 × 3.1 = ____________

B. 120 × 0.33 = ____________

C. 2.25 × 0.51 = ____________

ASSIGNMENT SHEET #15

D. 35 × 8.5 = ____________________

E. 26.4 × 3.8 = ____________________

F. 7.02 × 0.92 = ____________________

G. 0.83 × 0.55 = ____________________

H. 28.2 × 0.9 = ____________________

ASSIGNMENT SHEET #15

I. 0.069 × 0.01 = ________________

J. 7.52 × 3.01 = ________________

K. 32.1 × 29.9 = ________________

L. 0.168 × 12 = ________________

M. 78 × 9.1 = ________________

ASSIGNMENT SHEET #15

N. 69.3 × 0.75 = ________________

O. 0.043 × 2.4 = ________________

P. 574 × 0.34 = ________________

Q. 10.52 × 0.54 = ________________

R. 9.06 × 4.3 = ________________

ASSIGNMENT SHEET #15

S. 21.6 × 0.3 = ________________

T. 60.1 × 8.2 = ________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #16 — SOLVE DIVISION PROBLEMS WITH DECIMALS

NAME ______________________________ SCORE ______________

Division with decimals is like division with whole numbers. However, before you begin to divide, you must decide where the decimal point should be placed in the quotient.

First, study the number by which you are dividing (divisor). If that number is a decimal, move the decimal point to the right so that you change the decimal to a whole number. Then move the decimal point the same number of places to the right in the number into which you are dividing (dividend).

EXAMPLES: Decimal point moved one place in both numbers

$$.2_{\wedge}\overline{)\overset{.}{}.4_{\wedge}} \qquad\qquad \begin{array}{r} 2. \\ 2.\overline{)4.} \\ \underline{4} \\ 0 \end{array}$$

Decimal point moved two places in both numbers

$$.14_{\wedge}\overline{)14.02_{\wedge}\overset{.}{}8} \qquad\qquad \begin{array}{r} 100.2 \\ 14.\overline{)1402.8} \\ \underline{14} \\ 002\,8 \\ \underline{2\,8} \\ 0 \end{array}$$

Decimal point moved one place in both numbers; note that a zero had to be added

$$1.3_{\wedge}\overline{)26.0_{\wedge}\overset{.}{}} \qquad\qquad \begin{array}{r} 20. \\ 13.\overline{)260.} \\ \underline{26} \\ 0 \end{array}$$

No decimal point was moved to the right because 3 is already a whole number

$$3\overline{)\overset{.}{}.6} \qquad\qquad \begin{array}{r} .2 \\ 3\overline{).6} \\ \underline{6} \\ 0 \end{array}$$

ASSIGNMENT SHEET #16

Solve the following division problems. Check your answers. Show your work.

A. 4.5 ÷ 0.5 = _______

B. 4.96 ÷ 0.4 = _______

C. 19.8 ÷ 0.6 = _______

D. 10.71 ÷ 0.07 = _______

E. 0.225 ÷ 0.15 = _______

ASSIGNMENT SHEET #16

F. 1.7608 ÷ 0.0062 = _______

G. 0.48 ÷ 0.6 = _______

H. 0.125 ÷ 0.25 = _______

I. 0.9 ÷ 0.003 = _______

J. 1.16 ÷ 2.9 = _______

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ASSIGNMENT SHEET #16

K. 75 ÷ 0.03 = ________

L. 108 ÷ 0.09 = ________

M. 84 ÷ 0.007 = ________

N. 459 ÷ 2.7 = ________

O. 64 ÷ 0.16 = ________

ASSIGNMENT SHEET #16

P. 125 ÷ 0.25 = _______

Q. 34 ÷ 8.5 = _______

R. 6 ÷ 0.12 = _______

S. 406 ÷ 0.029 = _______

T. 8433 ÷ 0.09 = _______

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BASIC MATH
UNIT I

ASSIGNMENT SHEET #17 — WRITE FRACTIONS AS DECIMALS AND PERCENTAGES

NAME ____ SCORE ________________

Common fractions can also be expressed as decimal fractions, called *decimals.*

$1\,{}^{5}/_{10} = 1.5$	tenths
$1\,{}^{25}/_{100} = 1.25$	hundredths
$1\,{}^{125}/_{1000} = 1.125$	thousandths

In practical math, percentage is often useful. Percent means per hundredths. Five percent means five one-hundredths and may be written three ways: ${}^{5}/_{100}$, 0.05, and 5%. ALL HAVE THE SAME MATHEMATICAL VALUE.

A. Match the decimal notations on the right to their correct equivalent fractions. Write the correct letters in the blanks.

______	1.	$5\,{}^{6}/_{10}$	a.	7.083
______	2.	$1\,{}^{2}/_{100}$	b.	5.006
______	3.	${}^{87}/_{1000}$	c.	78.3
______	4.	$7\,{}^{03}/_{1000}$	d.	0.087
______	5.	$5\,{}^{6}/_{100}$	e.	0.783
______	6.	$5\,{}^{6}/_{1000}$	f.	87.7
______	7.	$78\,{}^{3}/_{10}$	g.	5.6
______	8.	$87\,{}^{7}/_{10}$	h.	102.0
______	9.	102	i.	5.06
______	10.	${}^{783}/_{1000}$	j.	1.02

B. Write the numbers in decimal notation for each of the following.

1. $63\,{}^{9}/_{10}$ = ____________________
2. $5\,{}^{93}/_{100}$ = ____________________
3. $5\,{}^{93}/_{1000}$ = ____________________
4. $5\,{}^{93}/_{10000}$ = ____________________
5. $3\,{}^{825}/_{1000}$ = ____________________
6. $38\,{}^{95}/_{100}$ = ____________________
7. $38\,{}^{95}/_{1000}$ = ____________________
8. $42\,{}^{3}/_{10}$ = ____________________
9. $402\,{}^{3}/_{10}$ = ____________________
10. $897\,{}^{97}/_{100000}$ = ____________________

ASSIGNMENT SHEET #17

C. Express each fraction as a decimal.

1. 1/8 = ________
2. 1/4 = ________
3. 1/2 = ________
4. 3/4 = ________
5. 5/8 = ________
6. 7/20 = ________
7. 7/16 = ________
8. 1/9 = ________
9. 4/9 = ________
10. 4/5 = ________

D. Express each fraction as a percentage.

1. 1/4 = ________
2. 2/9 = ________
3. 7/10 = ________
4. 3/4 = ________
5. 2/2 = ________
6. 9/11 = ________
7. 1/3 = ________
8. 4/9 = ________
9. 2/6 = ________
10. 5/8 = ________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #18 — WRITE DECIMALS AS FRACTIONS AND PERCENTAGES

NAME ______________________________ SCORE ______________

Just as knowing how to change fractions into decimals and percentages is sometimes helpful, knowing how to change decimals into fractions and percentages is also helpful. Review Section XXI of the Information Sheet, and then do the following practice.

Express each of the following decimals as a fraction and as a percentage.

		FRACTION	PERCENTAGE
A.	0.25	________	________
B.	0.375	________	________
C.	0.5	________	________
D.	0.875	________	________
E.	0.75	________	________
F.	0.6666	________	________
G.	0.3125	________	________
H.	0.9	________	________
I.	0.8	________	________
J.	0.625	________	________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #19 — WRITE PERCENTAGES AS FRACTIONS AND DECIMALS

NAME ______________________________ SCORE ____________

Changing percentages into fractions and decimals is sometimes helpful. Review Section XXII of the Information Sheet, and then do the following practice.

A. Express each percentage as a fraction.

1. 50% = ________
2. 25% = ________
3. 33 $^1/_3$% = ________
4. 36% = ________
5. 28% = ________
6. 14 $^2/_7$% = ________
7. 21% = ________
8. 45% = ________
9. 66 $^2/_3$% = ________
10. 70% = ________

B. Express each percentage as a decimal.

1. 47% = ________
2. 15% = ________
3. 33.3% = ________
4. 62% = ________
5. 75% = ________
6. 3% = ________
7. 16.8% = ________
8. 9% = ________
9. 10% = ________
10. 50% = ________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #20 — SOLVE PERCENTAGE PROBLEMS

NAME ____________________________ SCORE ______________

In practical math, percentage is often useful. *Percent* means per hundredths, and every percentage is a fraction of 100.

EXAMPLE: 15% means $^{15}/_{100}$ (or 0.15).

A. What does it mean to say 100 percent of the work is completed? ______________

____

B. There are usually one hundred tools in the tool shed. Fourteen of them are missing. What percent of the tools are missing? ______________________

C. 1. If fourteen of the tools are missing in the above problem, how many are present?

   ____

   2. What percent are present? ______________________

D. 1. There are one hundred bricks in a stack. Twenty-five bricks are what percent of the bricks in the stack? ______________________

   2. Five bricks are what percent of the bricks in the stack? ______________

E. There are one hundred jobs on the agenda. Ninety-four have been completed. What percent of the jobs have been completed? ______________________

F. 1. If ninety-four of the jobs in the above problem have been completed, how many have not been completed? ______________________

   2. What percent have not been completed? ______________________

G. If 11 percent of the students in a school are absent, what percent are present? _____

ASSIGNMENT SHEET #20

H. If 6 percent of the modular spacing rules that a store had in stock were not sold, what percent were sold? ______________________________

I. If 60 percent of the bricklayers in town had cards, what percent did not have cards?

____

J. Bill has a set of bricklaying tools. Ten percent of his tools are a year old, and [illegible] percent are over a year old. What percent are less than a year old? ______________

K. Susan has three types of jointers — flat, concave, and V. Eighty percent of her jointers are flat, and 15 percent are V. What percent are concave? ______________

L. The Smiths spent 22 percent of their income for their business, 17 percent for tools, 15 percent for work clothes, and 8 percent for beer. What percent was left for other things?

____

M. Chester has finished 75 percent of the block laying he is doing. What percent does he still have to do? ______________________________

N. Betty has completed 40 percent of her training. What percent does she still have to do?

____

O. If you were told to complete 93 percent of the work, what percent would be left?

____

BASIC MATH
UNIT I

ASSIGNMENT SHEET #21 — FIND PERCENTAGES OF WHOLE NUMBERS

NAME ______________________________ SCORE ____________

A percentage is a fraction of 100 and may be written as a ratio of the part (percentage) to the whole (100). In solving percentage problems, "X" represents the unknown. Set up two ratios as fractions (each fraction representing the part to the whole) and place an equal sign between them. Review Section XXIII of the Information Sheet, and then solve the following problems.

EXAMPLE: What number is 14% of 76?

$$\frac{14}{100} = \frac{X}{76}$$

$$100X = 1064$$

$$X = 10.64$$

A. Solve each of the following problems. Show your work.

1. 3% of 72 is what number? ________

2. 5% of 18 is what number? ________

3. What number is 33 1/3% of 96? ________

ASSIGNMENT SHEET #21

4. 40% of 125 is what number? ________

5. 68% of 63.5 is what number? ________

6. What number is 12 ½% of 140.8? ________

7. What number is 1% of 103? ________

8. What number is 37 ½% of 152? ________

ASSIGNMENT SHEET #21

9. 50% of 32.8 is what number? ________

10. 7% of 163 is what number? ________

B. Solve the following word problems. Show your work.

1. There are twenty students in a class. Sixty percent of the students are boys. How many are boys? ________________

2. One day 5 percent of the twenty bricklayers in Mr. Moore's group made perfect time completing a job. How many bricklayers made perfect time? ________________

ASSIGNMENT SHEET #21

3. Contractor McGill bought a new mortar box — regularly selling for $120 — at a sale and saved 20 percent. How much did he save? ________________

4. The number of bricklayers at the meeting this week was 75 percent of what it was last week. Last week there were eight hundred bricklayers at the meeting. How many bricklayers were at the meeting this week? ________________.

5. Thirty-three and one-third percent of 150 safety forms have been filled out. How many forms have been filled out? ________________

6. What is 75 percent of 20? ________________

ASSIGNMENT SHEET #21

7. On one day only 65 percent of the 120 students in Highland Trade School were present. How many students were present? ________________

BLC - 99-B

BASIC MATH
UNIT I

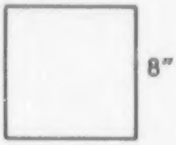
ASSIGNMENT SHEET #22 — CALCULATE AREAS

NAME ______________________________ SCORE ______________

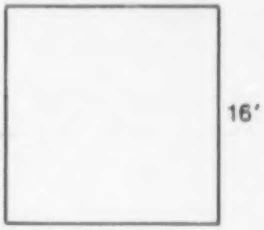
It is often necessary to find the area of geometric figures. Remember that area is calculated in square units.

A. Calculate the area for each of the following squares.

1. A = ____________________



2. A = ____________________



3. Square = 15′ × 15′

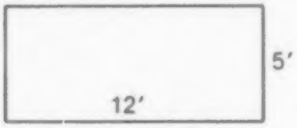
A = ____________________

4. Square = 36 yd × 36 yd

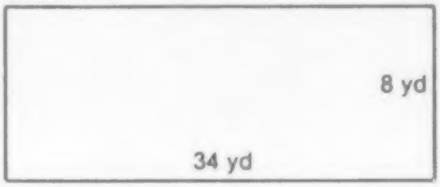
A = ____________________

B. Calculate area for each of the following rectangles.

1. A = ____________________



2. A = ____________________



3. L = 17"; W = 31"

A = ____________________

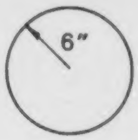
4. L = 16′; W = 62′

A = ____________________

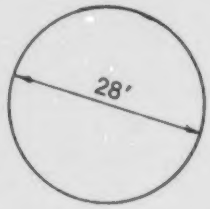
ASSIGNMENT SHEET #22

C. Calculate area for each of the following circles. (Use $\pi = 3.14$.)

1. A = ______________________________



2. A = ______________________________



3. Radius = 16'

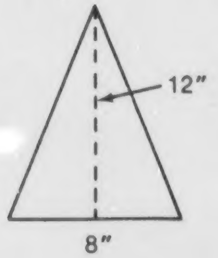
A = ______________________________

4. Diameter = 25 yd

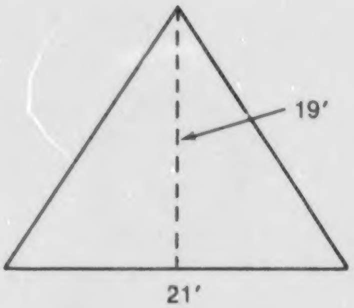
A = ______________________________

D. Calculate area for each of the following triangles.

1. A = ______________________________



2. A = ______________________________



ASSIGNMENT SHEET #22

3. B = 13"; H = 3"

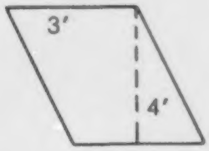
A = ____________________

4. B = 24 yd; H = 15 yd

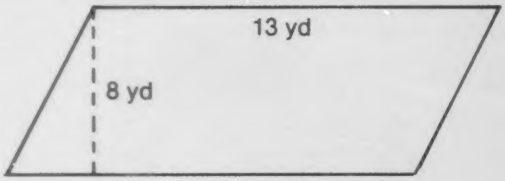
A = ____________________

E. Calculate area for each of the following parallelograms.

1. A = ____________________



2. A = ____________________



3. B = 16"; H = 16"

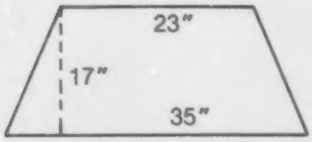
A = ____________________

4. B = 27 yd; H = 9 yd

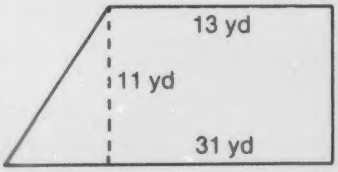
A = ____________________

F. Calculate area for each of the following trapezoids.

1. A = ____________________



2. A = ____________________


13 yd
11 yd
31 yd

3. H = 12'; B_1 = 9'; B_2 = 19'

A = ____________________

4. H = 17 yd; B_1 = 39 yd; B_2 = 51 yd

A = ____________________

BASIC MATH
UNIT I

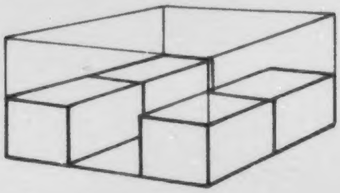
ASSIGNMENT SHEET #23 — DETERMINE VOLUME BY COUNTING

NAME ______________________ SCORE __________

One way to determine volume is by counting. When observation is possible, you can count the number of units in a three-dimensional figure.

A. Answer these questions about the figure below.

1. How many cubes are in the box? ______________________
2. How many additional cubes are needed to complete the bottom layer? ______
3. How many layers can the box hold inside? ______________________
4. How many cubes are needed for the top layer? ______________________
5. How many cubes would there be if the box were full? ______________________
6. What is the volume of the box? ______________________

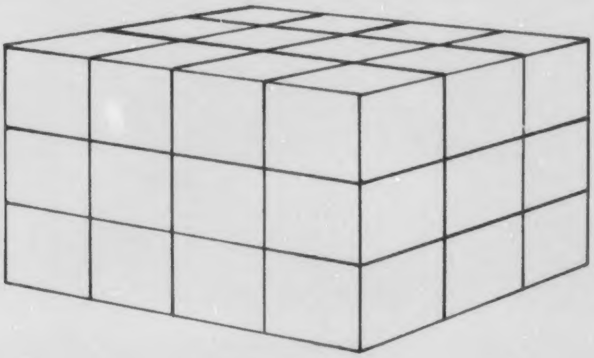


B. Answer these questions about the figure below.

1. How many cubes are in the bottom layer? ______________________
2. How many layers are there? ______________________
3. What is the way to figure the volume *without counting* all the cubes one by one?

____

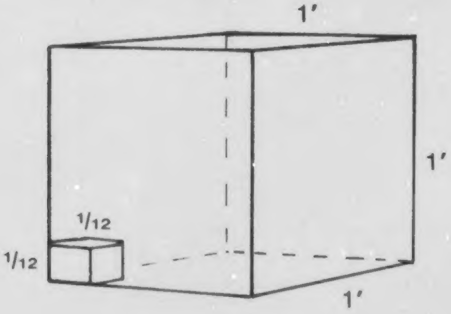
____



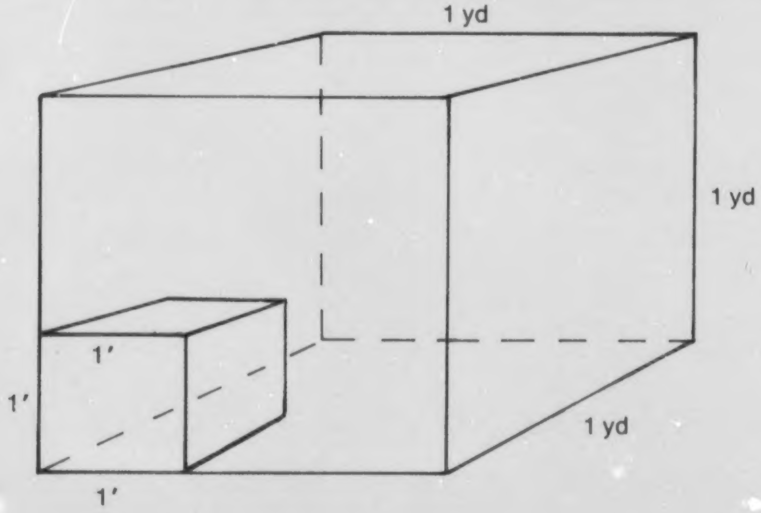
ASSIGNMENT SHEET #23

C. Answer these questions about the figure below.

1. How many cubic inches in 1 cubic foot? (Think of stacking cubic inches in a cubic foot box.) ____________________
2. How many cubic inches would it take to fill one layer? ____________
3. How many cubic inches would it take to fill two layers? ____________
4. How many cubic inches would it take to fill three layers? ____________
5. How many layers would it take to fill the box? ____________



D. How many cubic feet are in 1 cubic yard? ____________________

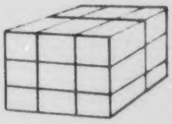


ASSIGNMENT SHEET #23

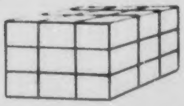
E. Count the number of cubes in the height, width, and length of the figures shown. Record the dimensions in the chart and determine the volumes. Remember that volume is calculated in cubic units.

	Height = H	Width = W	Length = L	Volume = V
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

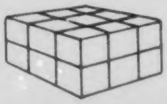
1.



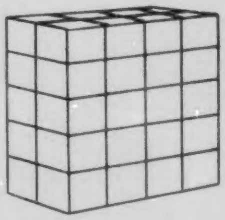
2.



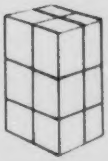
3.



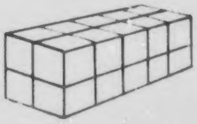
4.



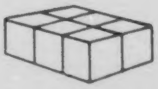
5.



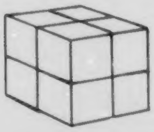
6.



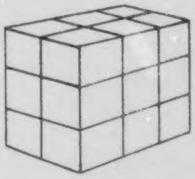
7.



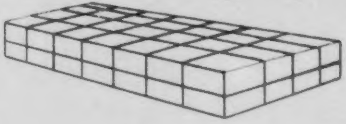
8.



9.



10.



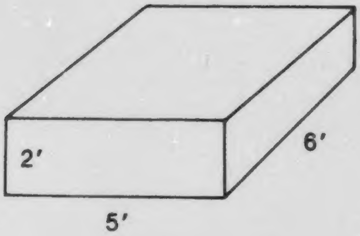
BASIC MATH
UNIT I

ASSIGNMENT SHEET #24 — CALCULATE VOLUME, USING A FORMULA

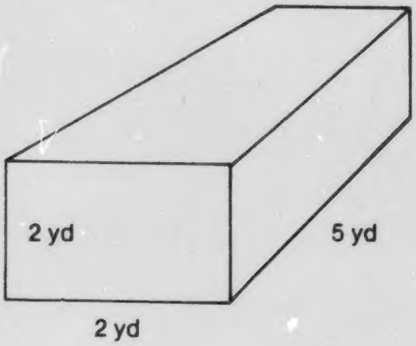
NAME ____________________ SCORE ____________

The formula V = LWH is used to calculate the volume of a figure that has length, width, and height. Use the formula to determine the volumes of the following figures.

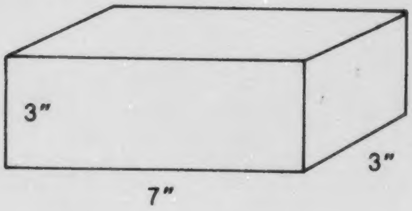
A. V = ____________________



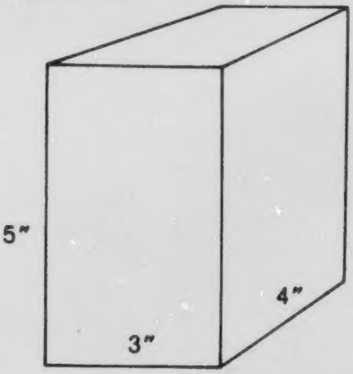
B. V = ____________________



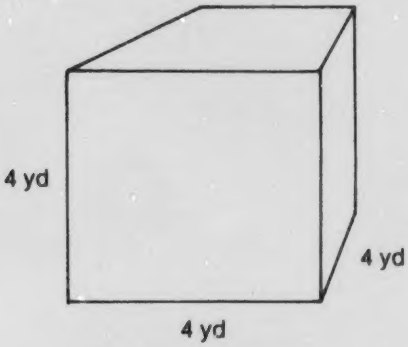
C. V = ____________________



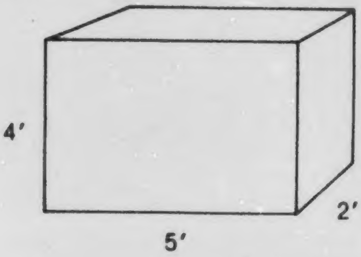
D. V = ____________________



E. V = ____________________



F. V = ____________________



BASIC MATH
UNIT I

ASSIGNMENT SHEET #25 — ESTIMATE CUBIC YARDS

NAME ______________________ SCORE __________

To order the amount of materials needed for certain jobs, you must estimate cubic yards even though measurements are usually given in feet and inches. Solve the following problems involving cubic yards. Show your work.

A. How many cubic yards of mortar will it take for a brick drive if the bed is 20 feet wide by 72 feet long by 1 inch thick? ______________________

B. Find the total cubic yards of insulation needed to fill a cavity wall if the cavity is 8 feet high, 22 feet long, and 6 inches wide? ______________________

C. How many cubic yards of grout will it take to fill a cavity 12 feet high, 37 feet long, and 3 inches wide? ______________________

ASSIGNMENT SHEET #25

D. Find the total cubic yards of sand it will take to fill a swimming pool 34 feet wide, 45 feet long, and 4 inches deep? ____________________

E. How many cubic yards of concrete will it take to pour a sidewalk 6 feet wide, 118 feet long, and 4 inches thick? ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #26 — SOLVE BASIC RATIO AND PROPORTION PROBLEMS

NAME ____________________________________ SCORE ______________

Ratio indicates parts of material per mix. Proportion indicates that two ratios are equal but have different quantities of material. Solve the following problems. Show your work.

A. Convert this ratio to whole numbers.

0.33:0.33:1 = ____________________

B. What would be the proportion if the following mix were cut in half?

1:2:12 = ____________________

C. What would be the proportion if the following ratio were tripled?

1:1:3 = ____________________

ASSIGNMENT SHEET #26

D. You are asked to mix a batch of mortar using 1:1:6 ratio. What will be the proportion using a ratio six times larger? ____________________________________

E. A mixture of 1 part cement, 1 part lime, and 3 parts sand is needed to make 25 cubic feet of mortar. How many cubic feet of each are needed? ____________________

BASIC MATH
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A.
1. 11
2. 16
3. 13
4. 23
5. 108
6. 88
7. 242
8. 1538
9. 1917
10. 16,430

B. 1182

C. 2177

D. $609

E. 12,103

Assignment Sheet #2

A.
1. 2
2. 7
3. 53
4. 406
5. 424
6. 9119
7. 1175
8. 1810
9. 51,451
10. 89,722

B. 126

C. 1160

D. 4410

E. 14,145

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #3

A.
1. 42
2. 72
3. 324
4. 2884
5. 8410
6. 2028
7. 21,291
8. 165,478
9. 503,605
10. 5,458,852

B. 68,383

C. 8160

D. 17,100

E. $6480

Assignment Sheet #4

A.
1. 4
2. 8
3. 91
4. 312
5. 3
6. 3
7. 62, R 4
8. 2, R 97
9. 1, R 365
10. 3, R 634

B. 1035

C. $18

D. $33.33

E. 109

Assignment Sheet #5

PART I

A.
1. 5, 7
2. numerator, denominator
3. 1, 3

ANSWERS TO ASSIGNMENT SHEETS

B.
1. 10/17
2. 16/37

C.
1. 1/8
2. 1
3. 8

PART II

A.
1. d
2. j
3. p
4. f
5. i
6. c
7. o
8. n
9. b
10. k
11. m
12. l
13. a
14. e
15. g

B. Evaluated to the satisfaction of the instructor

Assignment Sheet #6

PART I

A.
1. P
2. P
3. I
4. M
5. P
6. I
7. I
8. M
9. I
10. M
11. M
12. I
13. I
14. P
15. M

B. Evaluated to the satisfaction of the instructor

PART II

A.
1. 13/4
2. 9/2
3. 22/3
4. 17/2
5. 20/3
6. 26/5
7. 14/3
8. 57/7
9. 46/5
10. 50/3
11. 5/2
12. 14/4
13. 31/4
14. 29/3
15. 17/3
16. 49/8
17. 15/4
18. 34/5
19. 13/3
20. 9/5

ANSWERS TO ASSIGNMENT SHEETS

B.

1. 3 1/5
2. 2 2/5
3. 5 2/3
4. 2 2/3
5. 1 6/13
6. 1 1/7
7. 2 11/32
8. 1 7/17
9. 4 1/2
10. 1 2/3
11. 3 1/2
12. 2 1/4
13. 1 1/16
14. 2 1/5
15. 1 4/9
16. 1 3/4
17. 1 3/6
18. 1 1/3
19. 3 3/4
20. 2 3/7

Assignment Sheet #7

A. 1/3
B. 1/3
C. 2/3
D. 3/5
E. 1/4
F. 3/8
G. 5/7
H. 1/2
I. 3/4
J. 1/2
K. 1
L. 2/3
M. 1/3
N. 1/2
O. 5/6
P. 1/2
Q. 2/3
R. 1/3
S. 1
T. 3/4

Assignment Sheet #8

PART I

A. 6
B. 8
C. 3
D. 5
E. 8
F. 20
G. 3
H. 5
I. 9
J. 28
K. 3
L. 7
M. 10
N. 18
O. 3
P. 9

PART II

A. 48
B. 30
C. 12
D. 72

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #9

A. $\frac{11}{12}$

B. $1\frac{11}{20}$

C. $1\frac{8}{63}$

D. $1\frac{5}{24}$

E. $1\frac{7}{12}$

F. $1\frac{11}{24}$

G. $\frac{38}{45}$

H. $1\frac{4}{15}$

Assignment Sheet #10

A. $\frac{1}{12}$

B. $\frac{5}{24}$

C. $\frac{23}{60}$

D. $\frac{5}{24}$

E. $\frac{13}{72}$

F. $\frac{1}{6}$

G. $\frac{17}{40}$

H. $\frac{7}{30}$

I. $\frac{19}{63}$

J. $\frac{1}{48}$

Assignment Sheet #11

A. $\frac{3}{8}$

B. $\frac{15}{128}$

C. $3\frac{3}{8}$

D. $3\frac{1}{4}$

E. $\frac{7}{12}$

F. $1\frac{1}{2}$

G. $\frac{1}{24}$

H. $16\frac{27}{32}$

Assignment Sheet #12

A. $1\frac{1}{6}$

B. $\frac{3}{8}$

C. $1\frac{1}{24}$

D. $4\frac{2}{3}$

E. $2\frac{7}{10}$

F. $9\frac{1}{6}$

G. $\frac{3}{4}$

H. $13\frac{1}{3}$

I. $8\frac{1}{4}$

J. $42\frac{2}{3}$

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #13

A.	0.189	F.	1.072	K.	9.22	P.	0.0102
B.	5.99	G.	4.508	L.	71.01	Q.	13.132
C.	9.4	H.	287.706	M.	73.2	R.	0.4000
D.	29.26	I.	6.455	N.	19.29	S.	180.99
E.	3299.88	J.	30024.88	O.	0.87139	T.	56.000

Assignment Sheet #14

A.	351.98	F.	$4.15
B.	547.144	G.	670.4
C.	141.013	H.	4107.34
D.	508.16	I.	$2.47
E.	$749.25	J.	219.215

Assignment Sheet #15

A.	8.184	F.	6.4584	K.	959.79	P.	195.16
B.	39.6	G.	0.4565	L.	2.016	Q.	5.6808
C.	1.1475	H.	25.38	M.	709.8	R.	38.958
D.	297.5	I.	0.00069	N.	51.975	S.	6.48
E.	100.32	J.	22.6352	O.	0.1032	T.	492.82

Assignment Sheet #16

A.	9	F.	284	K.	2500	P.	500
B.	12.4	G.	0.8	L.	1200	Q.	4
C.	33	H.	0.5	M.	12,000	R.	50
D.	153	I.	300	N.	170	S.	14,000
E.	1.5	J.	0.4	O.	400	T.	93,700

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #17

A.
1. g
2. j
3. d
4. a
5. i
6. b
7. c
8. f
9. h
10. e

B.
1. 63.9
2. 5.93
3. 5.093
4. 5.0093
5. 3.825
6. 38.95
7. 38.095
8. 42.3
9. 402.3
10. 897.00097

C.
1. 0.125
2. 0.25
3. 0.5
4. 0.75
5. 0.625
6. 0.35
7. 0.4375
8. 0.11
9. 0.44
10. 0.8

D.
1. 25%
2. 22.22%
3. 70%
4. 75%
5. 100%
6. 81.81%
7. 33.33%
8. 44.44%
9. 33.33%
10. 62.5%

Assignment Sheet #18

A. 1/4; 25%
B. 3/8; 37 1/2%
C. 1/2; 50%
D. 7/8; 87 1/2%
E. 3/4; 75%
F. 2/3; 66 2/3%
G. 5/16; 31 1/4%
H. 9/10; 90%
I. 4/5; 80%
J. 5/8; 62 1/2%

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #19

A.	1.	1/2	6.	1/7
	2.	1/4	7.	21/100
	3.	1/3	8.	9/20
	4.	9/25	9.	2/3
	5.	7/25	10.	7/10
B.	1.	0.47	6.	0.03
	2.	0.15	7.	0.168
	3.	0.333	8.	0.09
	4.	0.62	9.	0.10
	5.	0.75	10.	0.50

Assignment Sheet #20

A. All work is completed

B. 14%

C. 1. 86
   2. 86%

D. 1. 25%
   2. 5%

E. 94%

F. 1. 6
   2. 6%

G. 89%

H. 94%

I. 40%

J. 50%

K. 5%

L. 38%

M. 25%

N. 60%

O. 7%

Assignment Sheet #21

A.	1.	2.16	6.	17.6
	2.	0.9	7.	1.03
	3.	32	8.	57
	4.	50	9.	16.4
	5.	43.18	10.	11.41

ANSWERS TO ASSIGNMENT SHEETS

B.
1. 12
2. 1
3. $24
4. 600
5. 50
6. 15
7. 78

Assignment Sheet #22

A.
1. 64 square inches
2. 256 square feet
3. 225 square feet
4. 1296 square yards

B.
1. 60 square feet
2. 192 square yards
3. 527 square inches
4. 992 square feet

C.
1. 113.04 square inches
2. 615.44 square feet
3. 803.84 square feet
4. 490.63 square yards

D.
1. 48 square inches
2. 199.5 square feet
3. 19.5 square inches
4. 180 square yards

E.
1. 12 square feet
2. 104 square yards
3. 256 square inches
4. 243 square yards

ANSWERS TO ASSIGNMENT SHEETS

F. 1. 493 square inches
   2. 242 square yards
   3. 168 square feet
   4. 765 square yards

Assignment Sheet #23

A. 1. 4 cubes
   2. 2 cubes
   3. 2 layers
   4. 6 cubes
   5. 12 cubes
   6. 12 cubic units

B. 1. 12 cubes
   2. 3 layers
   3. Evaluated to the satisfaction of the instructor

C. 1. 1728 cubic inches
   2. 144 cubic inches
   3. 288 cubic inches
   4. 432 cubic inches
   5. 12 layers

D. 27 cubic feet

ANSWERS TO ASSIGNMENT SHEETS

E. (NOTE: Answers may be reversed in the width and length columns.)

	H	W	L	V
1.	3	3	2	18
2.	3	3	3	27
3.	2	3	3	18
4.	5	2	4	40
5.	3	2	2	12
6.	2	2	5	20
7.	1	2	3	6
8.	2	2	2	8
9.	3	2	3	18
10.	2	4	7	56

Assignment Sheet #24

A. 60 cubic feet

B. 20 cubic yards

C. 63 cubic inches

D. 60 cubic inches

E. 64 cubic yards

F. 40 cubic feet

Assignment Sheet #25

A. 4.44 cubic yards

B. 3.26 cubic yards

C. 4.11 cubic yards

D. 18.88 cubic yards

E. 8.74 cubic yards

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #26

A. 1:1:3

B. 0.5:1:6

C. 3:3:9

D. 6:6:36

E. 5 cubic feet cement, 5 cubic feet lime, 15 cubic feet sand

BLC - 125-B

BASIC MATH
UNIT I

TEST

NAME ________________________________ SCORE ______________

1. Match terms associated with basic math to their correct definitions. Write the correct numbers in the blanks.

_____a. Mathematical proposition

_____b. Process of deducting one number from another; opposite (inverse) operation of addition

_____c. Relationship in quantity, amount, or size between two or more things; expressed with ratio symbol or division bar

_____d. First digit to the left of decimal

_____e. Any one of the ten Arabic numerals, 0 to 9, by which all numbers may be expressed

_____f. Zero or any positive or negative whole number

_____g. Relationship of one ratio to another

_____h. Opposite (inverse) operation of multiplication

_____i. Abbreviated process of adding an integer to itself a specified number of times

_____j. To solve by mathematical process

_____k. Symbol that indicates where something is to be inserted

_____l. Part of a whole; represents one or more equal parts of a unit

_____m. One part in a hundred; reckoned on basis of a whole divided into one hundred parts

_____n. Fraction based on the number 10; not written as common fraction

1. Calculate
2. Caret (∧)
3. Decimal
4. Digit
5. Division
6. Fraction
7. Integer
8. Multiplication
9. Percent
10. Problem
11. Proportion
12. Ratio
13. Subtraction
14. Unit

TEST

2. Match symbols used in math problems to their correct descriptions. Write the correct numbers in the blanks.

______a. Addition — 1. =

______b. Caret — 2. ×

______c. Equal — 3. −

______d. Subtraction — 4. ÷ $\overline{)\quad\quad}$

______e. Percent — 5. +

______f. Multiplication — 6. .

______g. Decimal — 7. ∧

______h. Division — 8. %

3. Solve the following addition problems.

a. $\begin{array}{r} 2 \\ \underline{+\ 9} \end{array}$ b. $\begin{array}{r} 5 \\ 7 \\ \underline{+\ 8} \end{array}$ c. $\begin{array}{r} 12 \\ 17 \\ \underline{+\ 99} \end{array}$ d. $\begin{array}{r} 142 \\ 759 \\ \underline{+\ 896} \end{array}$ e. $\begin{array}{r} 2345 \\ 9764 \\ \underline{+\ 8976} \end{array}$

4. Solve the following subtraction problems.

a. $\begin{array}{r} 9 \\ \underline{-\ 7} \end{array}$ b. $\begin{array}{r} 35 \\ \underline{-\ 9} \end{array}$ c. $\begin{array}{r} 481 \\ \underline{-\ 79} \end{array}$ d. $\begin{array}{r} 684 \\ \underline{-\ 342} \end{array}$ e. $\begin{array}{r} 9867 \\ \underline{-\ 8748} \end{array}$

5. Solve the following multiplication problems.

a. $\begin{array}{r} 7 \\ \underline{\times\ 5} \end{array}$ b. $\begin{array}{r} 68 \\ \underline{\times\ 9} \end{array}$ c. $\begin{array}{r} 735 \\ \underline{\times\ 68} \end{array}$ d. $\begin{array}{r} 649 \\ \underline{\times\ 537} \end{array}$ e. $\begin{array}{r} 8673 \\ \underline{\times\ 642} \end{array}$

6. Solve the following division problems.

a. $4\overline{)48}$ b. $16\overline{)64}$ c. $38\overline{)608}$

TEST

d. $421\overline{)842}$ e. $317\overline{)4569}$ f. $530\overline{)80960}$

7. Distinguish among types of fractions.

a. Write a "P" in the blanks before proper fractions, an "I" before improper fractions, and an "M" in the blanks before mixed numbers.

_____ 1) 1/3

_____ 2) 8 1/5

_____ 3) 7/7

_____ 4) 15 2/3

_____ 5) 5 2/7

_____ 6) 10/25

_____ 7) 2/5

_____ 8) 6 1/2

_____ 9) 1/4

_____ 10) 99/1

b. Write a "C" in the blanks before common fractions and a "U" in the blanks before uncommon fractions.

_____ 1) 1/16 and 7/16

_____ 2) 7/12 and 1/4

_____ 3) 1/4 and 1/6

_____ 4) 3/8 and 5/8

_____ 5) 2/7 and 2/5

8. Convert the following numbers and improper fractions.

a. Mixed numbers to improper fractions

1) 3 1/2 = __________________

2) 4 2/4 = __________________

3) 3 6/9 = __________________

4) 12 4/6 = __________________

5) 13 13/39 = __________________

TEST

b. Whole numbers to improper fractions

1) 8 expressed in halves = ____________________

2) 4 expressed in fourths = ____________________

3) 16 expressed in fourths = ____________________

4) 10 expressed in fifths = ____________________

5) 100 expressed in tenths = ____________________

c. Improper fractions to mixed numbers

(NOTE: Do not reduce to lowest terms at this time.)

1) $^{16}/_{5}$ = ____________________

2) $^{9}/_{4}$ = ____________________

3) $^{75}/_{32}$ = ____________________

4) $^{16}/_{7}$ = ____________________

5) $^{8}/_{5}$ = ____________________

9. Reduce the following fractions to lowest terms.

a. $^{4}/_{10}$ = ____________________

b. $^{8}/_{12}$ = ____________________

c. $^{7}/_{14}$ = ____________________

d. $^{8}/_{14}$ = ____________________

e. $^{12}/_{50}$ = ____________________

f. $^{4}/_{16}$ = ____________________

g. $^{2}/_{16}$ = ____________________

h. $^{8}/_{10}$ = ____________________

i. $^{12}/_{16}$ = ____________________

j. $^{121}/_{132}$ = ____________________

10. Add the following fractions. Reduce to lowest terms.

a. $^{1}/_{8} + ^{5}/_{8}$ = ____________________

b. $^{1}/_{16} + ^{15}/_{16}$ = ____________________

c. $^{2}/_{3} + ^{3}/_{3}$ = ____________________

d. $^{1}/_{2} + ^{4}/_{8}$ = ____________________

e. $^{4}/_{5} + ^{2}/_{3}$ = ____________________

f. $^{7}/_{8} + ^{6}/_{9}$ = ____________________

g. $2\ ^{1}/_{3} + 7\ ^{1}/_{7}$ = ____________________

h. $3\ ^{2}/_{4} + 16\ ^{1}/_{5}$ = ____________________

i. $4\ ^{2}/_{7} + 8\ ^{2}/_{3}$ = ____________________

j. $5\ ^{1}/_{5} + 6\ ^{2}/_{6}$ = ____________________

TEST

11. Find the lowest common denominators. Convert each fraction to its LCD equivalent.

a. 1) $7/32$, $5/8$ LCD = ______

2) $7/32$ = ______

3) $5/8$ = ______

b. 1) $1/2$, $2/3$, $3/4$ LCD = ______

2) $1/2$ = ______

3) $2/3$ = ______

4) $3/4$ = ______

c. 1) $3/16$, $3/4$, $1/8$ LCD = ______

2) $3/16$ = ______

3) $3/4$ = ______

4) $1/8$ = ______

d. 1) $4/5$, $7/8$, $3/4$ LCD = ______

2) $4/5$ = ______

3) $7/8$ = ______

4) $3/4$ = ______

e. 1) $7/8$, $5/6$ LCD = ______

2) $7/8$ = ______

3) $5/6$ = ______

f. 1) $2/3$, $5/6$, $1/2$ LCD = ______

2) $2/3$ = ______

3) $5/6$ = ______

4) $1/2$ = ______

12. Subtract the following fractions. Reduce to lowest terms.

a. $4/5 - 3/5$ = ______________

b. $6/8 - 2/8$ = ______________

c. $9/13 - 4/13$ = ______________

d. $3/6 - 1/3$ = ______________

e. $3/8 - 1/3$ = ______________

f. $14/16 - 7/8$ = ______________

g. $2\,3/4 - 1\,1/4$ = ______________

h. $6\,1/3 - 2\,1/2$ = ______________

i. $9\,2/5 - 4\,1/2$ = ______________

j. $12\,6/8 - 7\,1/3$ = ______________

TEST

13. Multiply the following fractions. Reduce to lowest terms. Show your work.

a. $\frac{1}{2} \times \frac{4}{5} =$ _____

b. $\frac{3}{4} \times \frac{3}{7} =$ _____

c. $\frac{9}{5} \times \frac{2}{3} =$ _____

d. $\frac{3}{4} \times 6\frac{1}{2} =$ _____

e. $6\frac{3}{4} \times 8\frac{3}{4} =$ _____

TEST

f. $7\frac{1}{3} \times 1\frac{1}{2} =$ ______

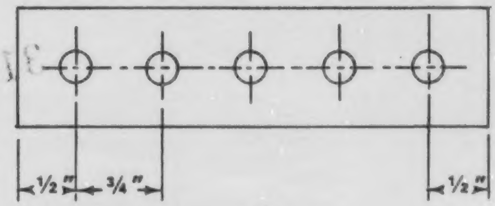
g. $\frac{77}{15} \times 5 =$ ______

h. A brick wall is 15 feet long. A section of the wall equal to $^1/_{20}$ of its total length must be removed. How long is this section? Convert your answer to inches. Show your work.

____________________inches

i. The template illustrated is to be drilled with five holes equally spaced. Find the length of the template. Show your work.

____________________inches



TEST

j. Two trucks are used to haul sand. The larger truck hauls 3 $\frac{1}{2}$ cubic yards per load, and the other hauls 2 $\frac{1}{4}$ cubic yards per load. If each truck hauls 16 loads, what is the total quantity in cubic yards of sand hauled? Show your work.

______________________cubic yards

14. Divide the following fractions. Reduce to lowest terms. Show your work.

a. $\frac{3}{8} \div \frac{3}{4} =$ _____

b. $2\frac{1}{2} \div \frac{2}{3} =$ _____

c. $\frac{3}{4} \div 5 =$ _____

TEST

d. $4\frac{1}{3} \div \frac{3}{8} =$ _____

e. $5\frac{3}{8} \div 3\frac{1}{4} =$ _____

f. $6\frac{2}{3} \div 2 =$ _____

g. $1\frac{7}{9} \div 5\frac{1}{4} =$ _____

h. A truck is loaded with stone, each stone weighing approximately 1/20 ton. If the total weight of the stone is 1 3/4 tons, how many stones are on the truck?

____________________ stones

i. How many bricks 9 inches long can be laid in a wall 16 feet long? What part of a brick is needed to finish the 16-foot wall?

____________________ bricks

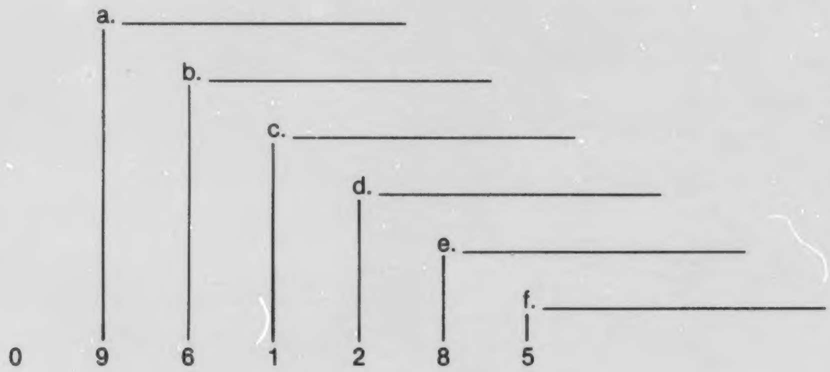
____________________ inches

TEST

j. If $^{1}/_{8}$ cubic yard of masonry cement is needed in mixing one cubic yard of mortar, how many cubic yards of mortar can be mixed using $^{7}/_{8}$ cubic yards of masonry cement?

______________________ cubic yards

15. Write the place value of each of the decimals in the number 0.961285 below.


a. ______________________
b. ______________________
c. ______________________
d. ______________________
e. ______________________
f. ______________________
0
9
6
1
2
8
5

16. Add the following decimals. Write problems in column form. Show your work.

a. 3.5 + 5.1 + 7 = ____________________

TEST

b. 3.4 + 0.206 + 1.74 = ____________________

c. 6.86 + 0.0505 + 7.9 + 82 = ____________________

d. 57.78 + 0.22 + 0.003 + 74 = ____________________

TEST

e. 6319 + 95.12 + 0.0713 + 321.07 = ________________

17. Subtract the following decimals. Write problems in column form. Check your work. Show your work.

a. 6.103 − 2.209 = ________________

TEST

b. 5.400 − 2.322 = ____________________

c. 7.38 − 0.063 = ____________________

d. 0.835325 − 0.25 = ____________________

TEST

e. 0.609375 − 0.359375 = ____________________

18. Multiply the following decimals. Show your work.

a. 2.6 × 4.7 = ____________________

b. 0.119 × 0.05 = ____________________

c. 9 × 0.8 = ____________________

TEST

d. $7.392 \times 92.07 =$ ____________________

e. $9.5 \times 0.76 =$ ____________________

19. Divide the following decimals and whole numbers by decimals. Check your work. Show your work.

a. $0.4\overline{)5.32}$

b. $0.6\overline{)83.4}$

TEST

c. $0.765 \div 0.5 =$ ____________________

d. $0.921 \div 0.3 =$ ____________________

e. $0.0225 \div 0.15 =$ ____________________

f. $24 \div 0.2 =$ ____________________

TEST

g. 54 ÷ 0.09 = ____________________

h. 63 ÷ 0.007 = ____________________

i. 812 ÷ 0.058 = ____________________

j. 4215 ÷ 0.040 = ____________________

TEST

20. Convert the following fractions to decimals and percentages. Express percentages as mixed numbers as needed.

		DECIMAL	PERCENTAGE
EXAMPLE:	$\frac{9}{16}$	0.5625	$56\frac{1}{4}\%$
a.	8/100 =	________	________
b.	3/25 =	________	________
c.	7/16 =	________	________
d.	2/7 =	________	________
e.	5/8 =	________	________

21. Convert the following decimals to fractions and percentages. Reduce fractions to lowest terms. Express percentages as mixed numbers as needed.

		FRACTION	PERCENTAGE
a.	.75	________	________
b.	0.8	________	________
c.	0.625	________	________
d.	0.375	________	________
e.	0.3125	________	________

22. Convert the following percentages to fractions and decimals. Reduce fractions to lowest terms.

		FRACTION	DECIMAL
a.	12% =	________	________
b.	30% =	________	________
c.	45% =	________	________
d.	72% =	________	________
e.	250% =	________	________

TEST

23. Solve the following percentage problems. Show your work.

    a. If a motor with 150 horsepower runs with 87 percent efficiency, how much horsepower does it deliver? ____________________

    b. If antifreeze evaporates 12 percent while in storage, how many gallons will be left of 2100 gallons of antifreeze placed in storage? ____________________

    c. If a contractor bought a forklift for $24,000, and sold it for $30,000, what was the percentage of profit? ____________________

TEST

24. Match terms associated with geometric figures to their correct definitions. Write the correct numbers in the blanks.

_____a. Volume that is 1 foot long, 1 foot wide, and 1 foot high

_____b. Relating to a straight line or length

_____c. Outer limits of area

_____d. Distance around outer edge of a circle

_____e. Theoretical size that may vary from actual size

_____f. Measure of a flat surface expressed in square units such as square feet

_____g. Line from center of a circle to any point on the circle

_____h. Extending in the same direction, an equal distance apart and never meeting

_____i. Space occupied by a body having length, height, and width; expressed in cubic units

_____j. Distance between outer edges of circle through the center point

_____k. Based on a nominal 4-inch spacing

_____l. Shapes formed by straight or curved lines

_____m. Greek letter used to represent the ratio of circumference of a circle to its diameter; approximately 3.14

_____n. Angle formed by two lines perpendicular to each other

_____o. Unit with three dimensions including length, width, and height

_____p. Line or surface at right angle to another line or surface

1. Area
2. Circumference
3. Cubic foot
4. Radius
5. Diameter
6. Perimeter
7. Linear
8. Volume
9. Nominal size
10. Parallel
11. Geometric figures
12. Perpendicular
13. Pi (π)
14. Cubic unit
15. Right angle
16. Modular

TEST

25. Match types of geometric figures to their correct descriptions. Write the correct numbers in the blanks.

______a. Figure having three sides and three angles

______b. Figure having four sides of equal length and four right angles

______c. Flat, round figure formed by one curved line; all points of the curved line are of equal distance from the center point

______d. Figure having four sides of equal length and no right angles

______e. Four-sided figure with only one pair of opposite sides parallel

______f. Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles

______g. Four-sided figure with two parallel ends of equal length and two parallel sides of equal length

1. Circle
2. Parallelogram
3. Trapezoid
4. Triangle
5. Rectangle
6. Rhombus
7. Square

26. Match units of measure to their correct definitions. Write the correct numbers in the blanks.

______a. Distance equal to 5280 feet

______b. Distance equal to 1/12 foot or 1/36 yard

______c. Distance equal to 3 feet or 36 inches

______d. Unit of measure for angles

______e. Distance equal to 16½ feet

______f. Distance equal to 12 inches or 1/3 yard

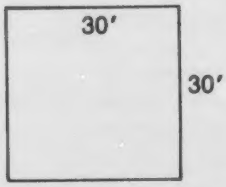
1. Inch (")
2. Foot (')
3. Yard
4. Rod
5. Mile
6. Degree (°)

TEST

27. Calculate area of each of the following geometric figures. Write the correct answers in the blanks.

a. Square

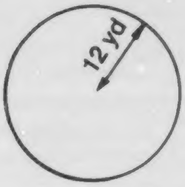
A = ____________________



b. Circle

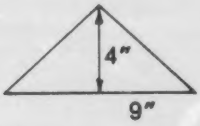
(NOTE: Use $\pi = 3.14$.)

A = ____________________



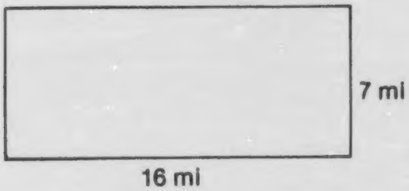
c. Triangle

A = ____________________



d. Rectangle

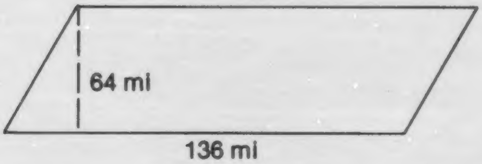
A = ____________________



TEST

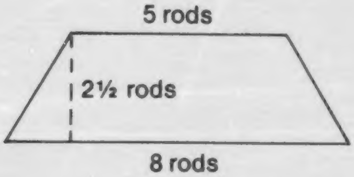
e. Parallelogram

A = ______________________________



f. Trapezoid

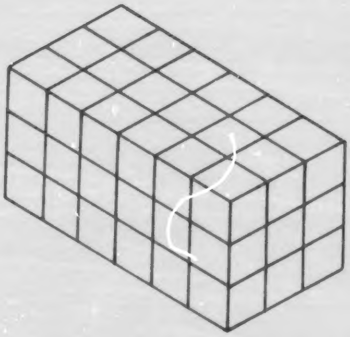
A = ______________________________

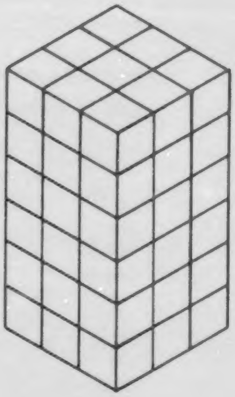

5 rods
2½ rods
8 rods

28. Calculate the volume of the following solid figures. Write the correct answers in the blanks.

a. Counting

1) V = ____________________ 2) V = ____________________



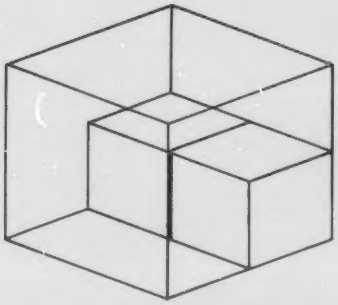


TEST

3) a) V = ____________________

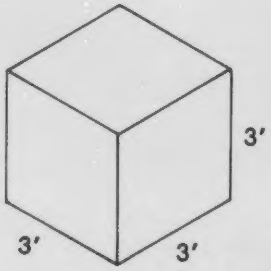
b) How many more cubes are needed to fill the box?

_____________ – _____________ = _____________

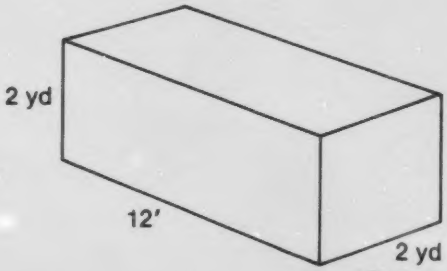


b. Using formula

1) V = ____________________



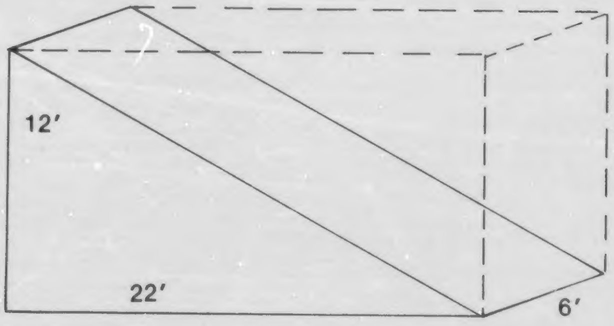
2) V = ____________________



ERIC

TEST

3) V = ____________________



4) How much fill will it take to fill an area 42 feet long by 36 feet wide by 6 inches high? Show your work.

V = ____________________

5) How much sand will it take to fill the bed of a truck 3 feet deep by 8 1/2 feet wide by 12 feet long? Show your work.

V = ____________________

TEST

6) What would be the volume of a mortar box 12 inches high, 72 inches long, and 36 inches wide? Show your work.

V = ____________________

7) Calculate the number of cubic yards of sand to fill an area 12 feet wide, 144 feet long, and 12 inches deep. Show your work.

V = ____________________

29. Solve the following basic ratio and proportion problems. Write the correct numbers in the blanks.

a. Convert this ratio to the lowest ratio with whole numbers.

0.5:0.5:2 = ____________________

b. Convert this ratio to decimals.

1:1:3 = ____________________

c. What would be the proportion if the following mix were doubled?

2.5:2.5:5 = ____________________

TEST

d. What would be the proportion if the following mix were cut to one third?

3:3:12 = ____________________

e. If a mixture of 2 parts cement, 4 parts lime, and 6 parts sand were needed to do a job, what would the proportion be and how many cubic feet of each material would it take to make 36 cubic feet of mortar?

____

BLC - 153-B

BASIC MATH
UNIT I

ANSWERS TO TEST

1.	a.	10	f.	7	k.	2
	b.	13	g.	11	l.	6
	c.	12	h.	5	m.	9
	d.	14	i.	8	n.	3
	e.	4	j.	1		

2.	a.	5	c.	1	e.	8	g.	6
	b.	7	d.	3	f.	2	h.	4

3.	a.	11	d.	1797
	b.	20	e.	21,085
	c.	128		

4.	a.	2	d.	342
	b.	26	e.	1119
	c.	402		

5.	a.	35	d.	348,513
	b.	612	e.	5,568,066
	c.	49,980		

6.	a.	12	d.	2
	b.	4	e.	14, R 131
	c.	16	f.	152, R 400

ANSWERS TO TEST

7.	a.	1)	P	6)	P	b.	1)	C
		2)	M	7)	P		2)	U
		3)	I	8)	M		3)	U
		4)	M	9)	P		4)	C
		5)	M	10)	I		5)	U

8.	a.	1)	7/2	b.	1)	16/2	c.	1)	3 1/5
		2)	18/4		2)	16/4		2)	2 1/4
		3)	33/9		3)	64/4		3)	2 11/32
		4)	76/6		4)	50/5		4)	2 2/7
		5)	520/39		5)	1000/10		5)	1 3/5

9.	a.	2/5	f.	1/4
	b.	2/3	g.	1/8
	c.	1/2	h.	4/5
	d.	4/7	i.	3/4
	e.	6/25	j.	11/12

10.	a.	3/4	f.	1 13/24
	b.	1	g.	9 10/21
	c.	1 2/3	h.	19 7/10
	d.	1	i.	12 20/21
	e.	1 7/15	j.	11 8/15

11.	a.	1)	LCD = 32
		2)	7/32
		3)	20/32

ANSWERS TO TEST

b. 1) LCD = 12
   2) $^{6}/_{12}$
   3) $^{8}/_{12}$
   4) $^{9}/_{12}$

c. 1) LCD = 16
   2) $^{3}/_{16}$
   3) $^{12}/_{16}$
   4) $^{2}/_{16}$

d. 1) LCD = 40
   2) $^{32}/_{40}$
   3) $^{35}/_{40}$
   4) $^{30}/_{40}$

e. 1) LCD = 24
   2) $^{21}/_{24}$
   3) $^{20}/_{24}$

f. 1) LCD = 6
   2) $^{4}/_{6}$
   3) $^{5}/_{6}$
   4) $^{3}/_{6}$

12.

a.	$^{1}/_{5}$	f.	0
b.	$^{1}/_{2}$	g.	1 $^{1}/_{2}$
c.	$^{5}/_{13}$	h.	3 $^{5}/_{6}$
d.	$^{1}/_{6}$	i.	4 $^{9}/_{10}$
e.	$^{1}/_{24}$	j.	5 $^{5}/_{12}$

ANSWERS TO TEST

13. a. 2/5
b. 9/28
c. 1 1/5
d. 4 7/8
e. 59 1/16
f. 11
g. 25 2/3
h. 9 inches
i. 4 inches
j. 92 cubic yards

14. a. 1/2
b. 3 3/4
c. 3/20
d. 11 5/9
e. 1 17/26
f. 3 1/3
g. 64/189
h. 35 stones
i. 21 bricks, 3 inches left
j. 7 7/8 cubic yards

15. a. Tenths
b. Hundredths
c. Thousandths
d. Ten-thousandths
e. Hundred-thousandths
f. Millionths

ANSWERS TO TEST

16. a. 15.6
    b. 5.346
    c. 96.8105
    d. 132.003
    e. 6735.2613

17. a. 3.894
    b. 3.078
    c. 7.317
    d. 0.585325
    e. 0.25

18. a. 12.22
    b. 0.00595
    c. 7.2
    d. 680.58144
    e. 7.22

19. a. 13.3
    b. 139
    c. 1.53
    d. 3.07
    e. 0.15
    f. 120.0
    g. 600.0
    h. 9000.0
    i. 14,000.0
    j. 105,375.0

20. a. 0.08; 8%
    b. 0.12; 12%
    c. 0.4375; $43\,{}^{3}/_{4}\%$
    d. 0.2857; $28\,{}^{57}/_{100}\%$
    e. 0.8333; $83\,{}^{1}/_{3}\%$

ANSWERS TO TEST

21. a. $^{3}/_{4}$; 75%
    b. $^{4}/_{5}$; 80%
    c. $^{5}/_{8}$; 62 $^{1}/_{2}$%
    d. $^{3}/_{8}$; 37 $^{1}/_{2}$%
    e. $^{5}/_{16}$; 31 $^{1}/_{4}$%

22. a. $^{3}/_{25}$; 0.12
    b. $^{3}/_{10}$; 0.30
    c. $^{9}/_{20}$; 0.45
    d. $^{18}/_{25}$; 0.72
    e. $^{5}/_{2}$; 2.50

23. a. 130.50 horsepower
    b. 1848 gallons
    c. 20 percent

24.	a.	3	e.	9	i.	8	m.	13
	b.	7	f.	1	j.	5	n.	15
	c.	6	g.	4	k.	16	o.	14
	d.	2	h.	10	l.	11	p.	12

25.	a.	4	e.	3
	b.	7	f.	5
	c.	1	g.	2
	d.	6		

ANSWERS TO TEST

26.
- a. 5
- b. 1
- c. 3
- d. 6
- e. 4
- f. 2

27.
- a. 900 square feet
- b. 452.16 square yards
- c. 18 square inches
- d. 112 square miles
- e. 8704 square miles
- f. 16 1/4 square rods

28.
- a.
  - 1) 54 cubic units
  - 2) 54 cubic units
  - 3)
    - a) 8 cubic units
    - b) 6 cubes
- b.
  - 1) 27 cubic feet or 1 cubic yard
  - 2) 16 cubic yards
  - 3) 792 cubic feet or 29 1/3 cubic yards
  - 4) 756 cubic feet or 28 cubic yards
  - 5) 306 cubic feet or 11 1/3 cubic yards
  - 6) 31,104 cubic inches or 18 cubic feet
  - 7) 64 cubic yards

29.
- a. 1:1:4
- b. 0.33:0.33:1 or 0.50:0.50:1.5
- c. 5:5:10
- d. 1:1:4
- e. 2:4:6 = 6:12:18

  6 cubic feet cement,12 cubic feet lime, and 18 cubic feet sand

MEASURING
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to read modular and brick spacing rules. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with measuring to their correct definitions.
2. Label basic measuring tools used by bricklayers.
3. Distinguish between modular and brick spacing rules.
4. Select from a list uses of modular and brick spacing rules.
5. Read a standard rule.
6. Describe procedures for reading modular and brick spacing rules.
7. Read measurements on a rule.
8. Measure objects.
9. Draw lines and objects to specified dimensions.
10. Mark course height on a story pole, using modular spacing rule.
11. Mark course height on a story pole, using a brick spacing rule.

MEASURING
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Obtain transparencies.

      (NOTE: Transparencies are available from AGC and CIMC.)

   B. Provide students with objective sheet.

   C. Discuss unit and specific objectives.

   D. Provide students with information and assignment sheets.

   E. Discuss information and assignment sheets.

   F. Provide rules, story poles, and corner poles for students to use when completing assignment sheets.

   G. Give test.

   H. Complete appropriate section of competency profiles.

      (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Transparency masters

      1. TM #1 — Measuring Tools
      2. TM #2 — Spacing Rods
      3. TM #3 — Modular Spacing Rule and Brick Spacing Rule
      4. TM #4 — Graduations on Standard Rule
      5. TM #5 — Reading the Eighths Rule
      6. TM #6 — Reading the Sixteenths Rule

SUGGESTED ACTIVITIES

7. TM #7 — Reading the Modular Rule

8. TM #8 — Reading the Spacing Rule

E. Assignment sheets

1. Assignment Sheet #1 — Read Measurements on a Rule

2. Assignment Sheet #2 — Measure Objects

3. Assignment Sheet #3 — Draw Lines and Objects to Specified Dimensions

4. Assignment Sheet #4 — Mark Course Height on a Story Pole, Using a Modular Rule

5. Assignment Sheet #5 — Mark Course Height on a Story Pole, Using a Spacing Rule

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit reference — Turcotte, Raymond J. *Bricklaying Curriculum.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and the Associated General Contractors of America, 1977.

MEASURING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Circumference — Distance around the outer edge of a circle

B. Corner pole — Tool used to establish or check corners and courses of masonry

C. Dimension — Number of full units and fractions of units between two points

D. Divisions — Parts or sections on a rule that make up 1 inch

E. Foot — Unit of measure consisting of twelve equal parts called inches

F. Fraction — Part of a whole; represents one or more equal parts of a unit

EXAMPLES: 1/4, 3/8, 1/2, 9/16

G. Inch — Smallest whole unit of linear measure commonly used

H. Linear — Relating to, consisting of, or resembling a straight line

I. Measuring — Setting limits or bounds according to a predetermined standard

J. Modular — Based on a nominal 4-inch spacing

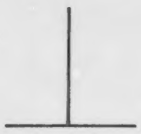
K. Nominal size — Theoretical size that may vary from the actual size

EXAMPLE: A 2 × 4 (nominal unit) actually measures 1 5/8" × 3 5/8"

L. Perpendicular — Line at right angle to another line or surface (Figure 1)

EXAMPLE:

FIGURE 1



INFORMATION SHEET

M. Rectangle — Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles (Figure 2)

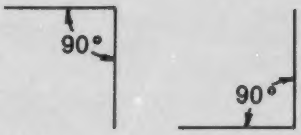
EXAMPLES:

FIGURE 2

N. Right angle — Angle formed by two lines perpendicular to each other (Figure 3)

EXAMPLES:

FIGURE 3



O. Rule — Measuring instrument graduated in whole units and fractions of units

P. Spacing — Number of inches for each course of masonry

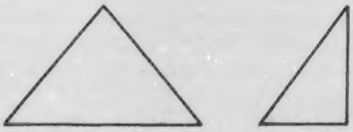
Q. Specifications — Detailed set of written instructions that supplement drawings; describe quality and type of materials and equipment used in structure and become part of contract

R. Story pole — Length of wood marked for course levels and/or course height

S. Triangle — Figure having three sides and three angles (Figure 4)

EXAMPLE:

FIGURE 4



T. Unit — First digit to the left of decimal

INFORMATION SHEET

II. Basic measuring tools used by bricklayers (Transparency #1)

  A. Modular spacing rule

  B. Brick spacing rule

  C. Steel tapes

  D. Steel framing square

III. Difference between modular and brick spacing rules

  A. Modular spacing rule

    1. Common method of determining spacing for modular brick and block

      (NOTE: The first joint of the rule automatically gives modular readings of 4, 8, and 12 inches.)

    2. All courses (8, 6, 5, 4, 3, and 2) scale out at 16 inches

    3. Reverse side has common denominations reading horizontally

  B. Brick spacing rule

    1. Common method of determining spacing for nonmodular brick

    2. Reverse side has common denominations reading vertically

IV. Uses of modular and brick spacing rules (Transparencies #2 and #3)

  A. Modular spacing rule

    1. Determining course height of designated number of modular courses in 16 inches

      (NOTE: The modular spacing rule should be used only for modular measurements.)

    2. Marking story pole or corner pole

  B. Brick spacing rule

    1. Determining number of courses and course height of designated number of courses in a given height

      (NOTE: The brick spacing rule should be used only for nonmodular measurements.)

    2. Marking story pole or corner pole

INFORMATION SHEET

V. Reading a standard rule (Transparencies #4-#6; Assignment Sheets #1-#3)

(NOTE: All rules read similarly. Some rules are graduated with more divisions per inch than others. Layout tapes are marked 16 inches on center.)

A. Determine the number of graduations per inch

1. Locate at the zero end of rule small figure that designates divisions per inch

2. Count divisions in 1 inch

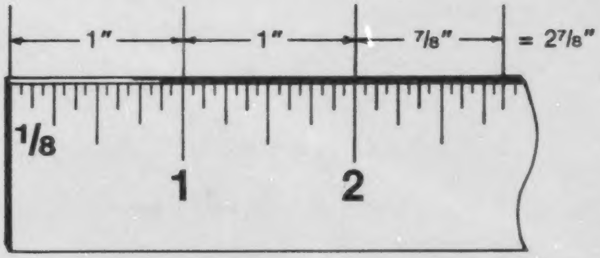
(NOTE: Practice to gain skill in determining the divisions.)

B. Determine inches and fractions of an inch

1. Count graduations in that fraction of an inch beyond last full inch (Figure 5)

EXAMPLE:

FIGURE 5



2. Add fraction to last full inch

(NOTE: In the example above, the total amount equals 2 7/8 inches.)

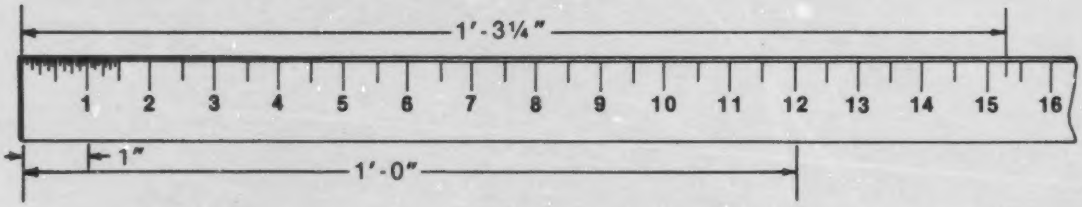
C. Reduce fraction if possible

INFORMATION SHEET

D. Convert measurement to feet if possible, and then add inches and fractions of an inch to obtain a correct measurement (Figure 6)

EXAMPLE:

FIGURE 6



VI. Reading modular and brick spacing rules (Transparencies #7 and #8; Assignment Sheets #4 and #5)

A. Modular spacing rule

1. Check specifications to determine course height and/or size of bricks

2. Determine number of courses in 16 inches

   EXAMPLE: Six courses of standard bricks equal 16 inches.

3. Read each reference number

   EXAMPLE: If there are six courses in 16 inches, each reference number 6 will be the height of each course.

4. Transcribe reference number to standard rule to determine exact course height

B. Brick spacing rule

1. Check specifications to determine course height and/or size of bricks

   EXAMPLE: Course height is 2 ¾ inches.

2. Determine height to be filled

   EXAMPLE: Floor to window sill is 22 inches; specifications call for eight courses in 22 inches.

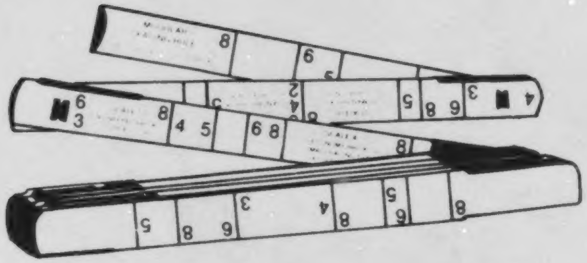
INFORMATION SHEET

3. Transcribe wall height to spacing rule

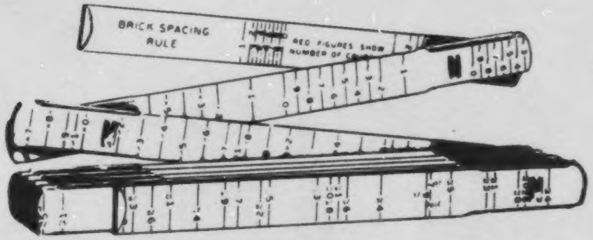
   EXAMPLE: Twenty-two inches equal eight courses, using reference number 6; first reference number 6 equals 2 3/4 inches.

4. Read each reference number to determine course height

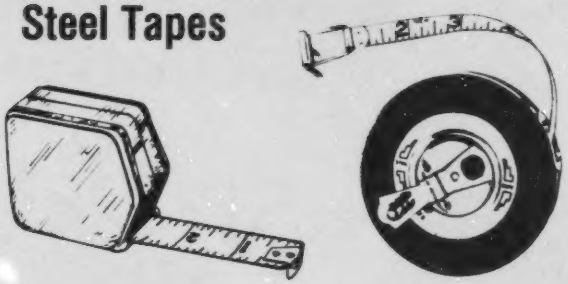
Measuring Tools



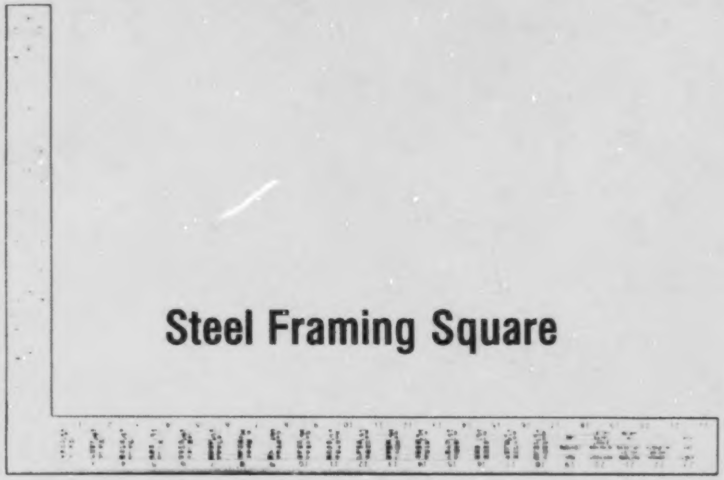
Modular Spacing Rule


BRICK SPACING RULE
RED FIGURES SHOW NUMBER OF COURSES

Brick Spacing Rule

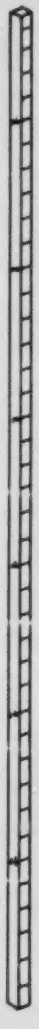


Steel Tapes

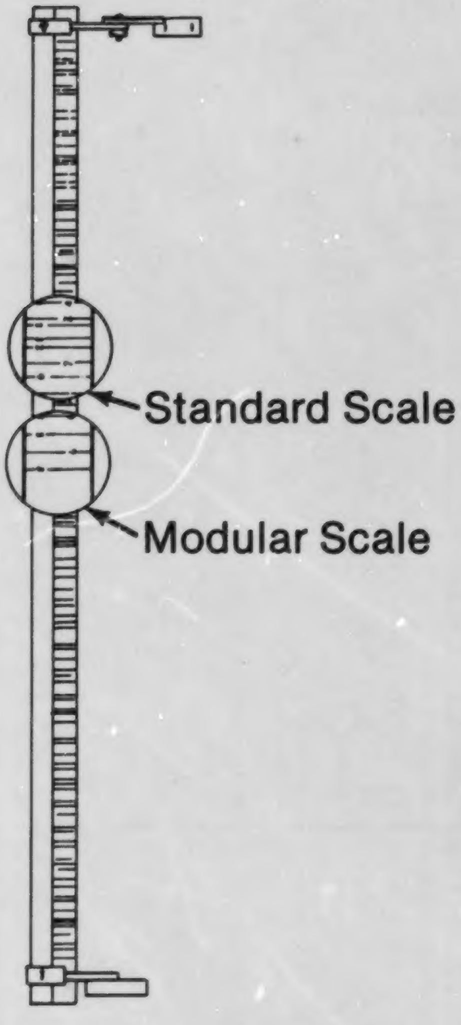


Steel Framing Square

Spacing Rods

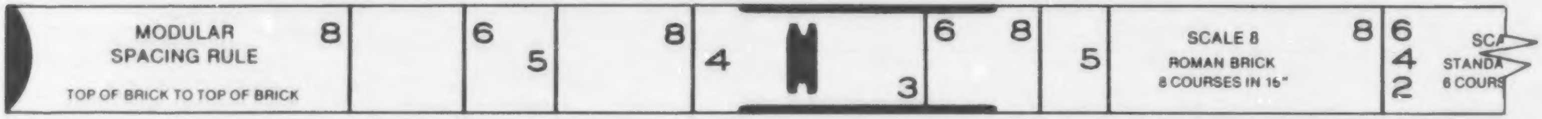


Story Pole

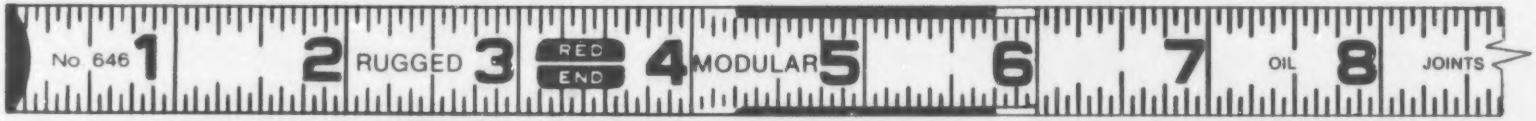

Standard Scale
Modular Scale

Corner Pole

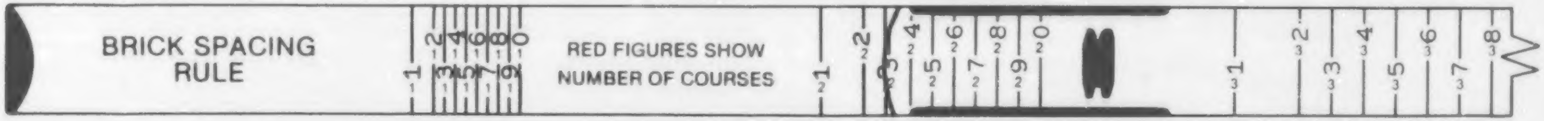
Modular Spacing Rule and Brick Spacing Rule


MODULAR
SPACING RULE
TOP OF BRICK TO TOP OF BRICK
8
6
5
8
4
3
6
8
5
SCALE 8
ROMAN BRICK
8 COURSES IN 16"
8
6
4
2
SCA
STANDA
6 COURS

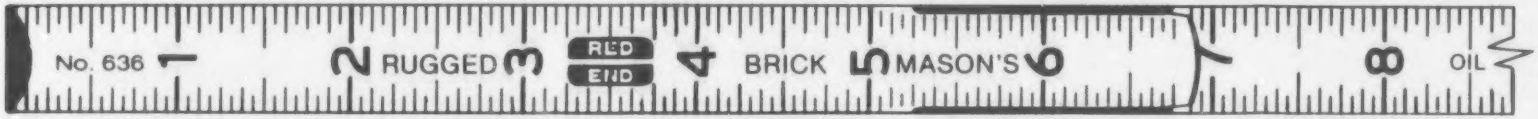
Modular Rule


No. 646
1
2
RUGGED
3
RED
END
4
MODULAR
5
6
7
OIL
8
JOINTS

Reverse Side


BRICK SPACING
RULE
RED FIGURES SHOW
NUMBER OF COURSES

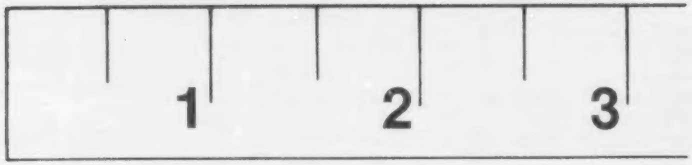
Brick Spacing Rule


No. 636
1
2
RUGGED
3
RED
END
4
BRICK
5
MASON'S
6
7
8
OIL

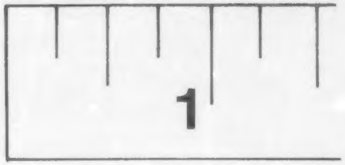
Reverse Side

Graduations on a Standard Rule

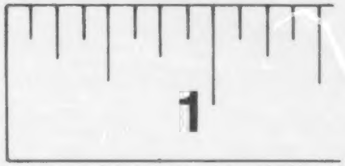
Halves



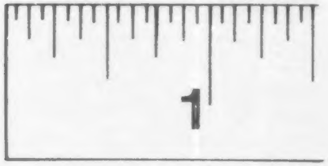
Quarters



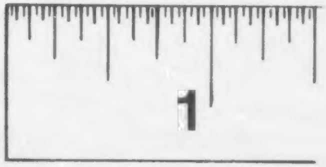
Eighths

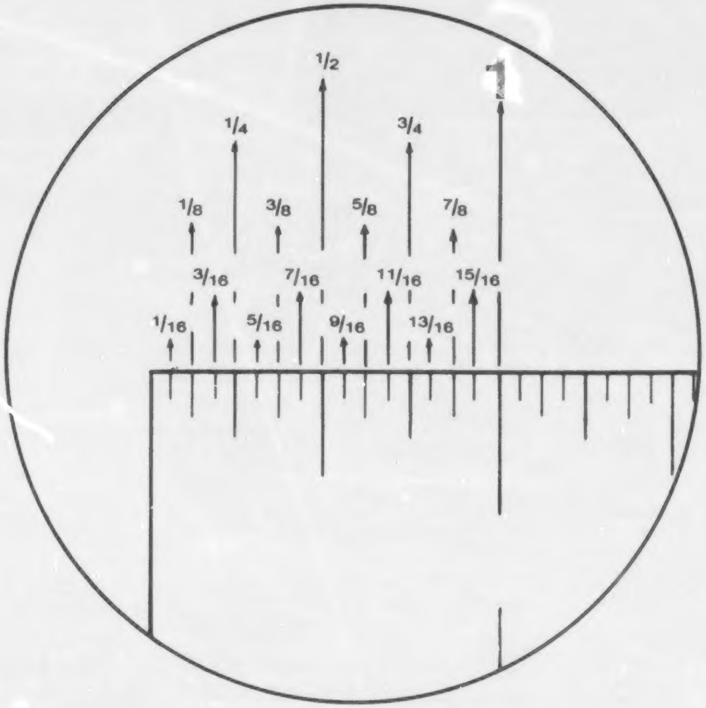


Sixteenths



Thirty-Seconds



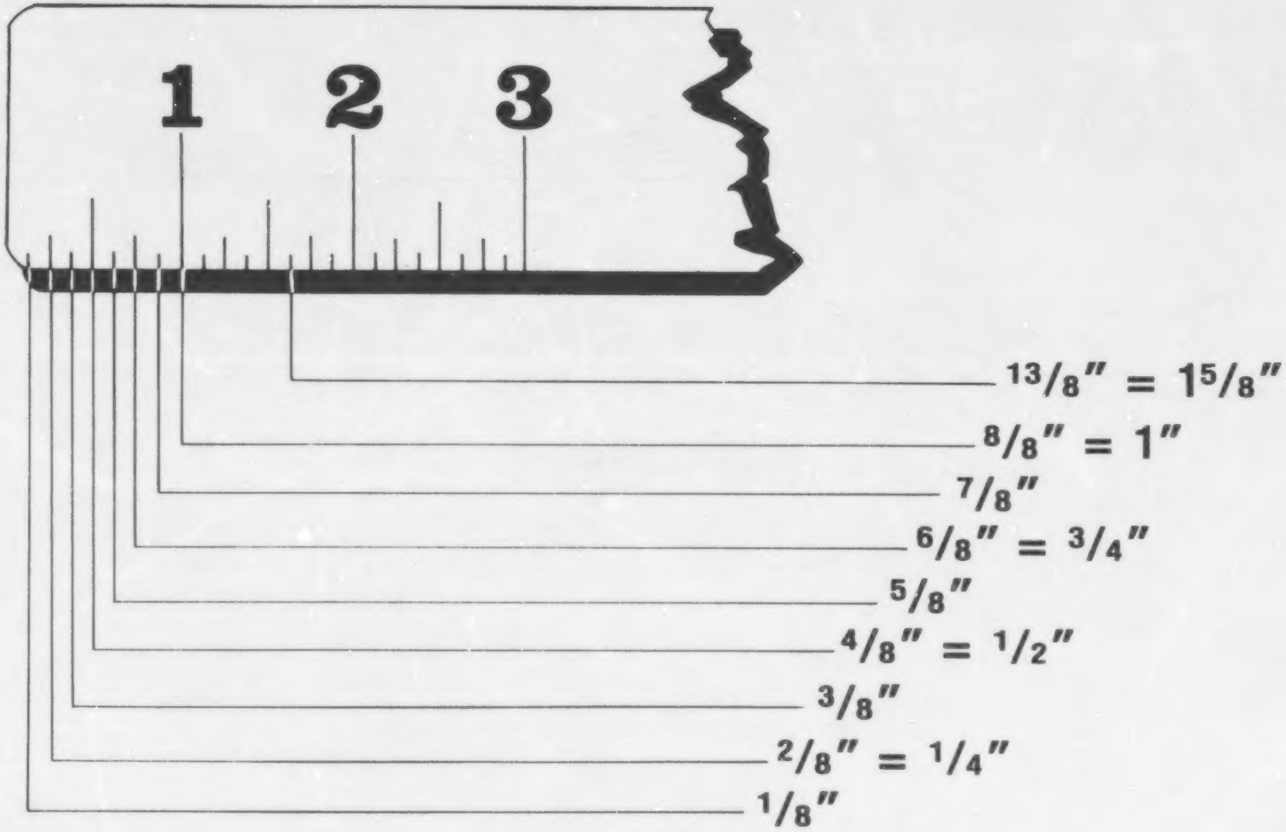

1/2
1
1/4
3/4
1/8
3/8
5/8
7/8
3/16
7/16
11/16
15/16
1/16
5/16
9/16
13/16

Graduations Applied to a Rule

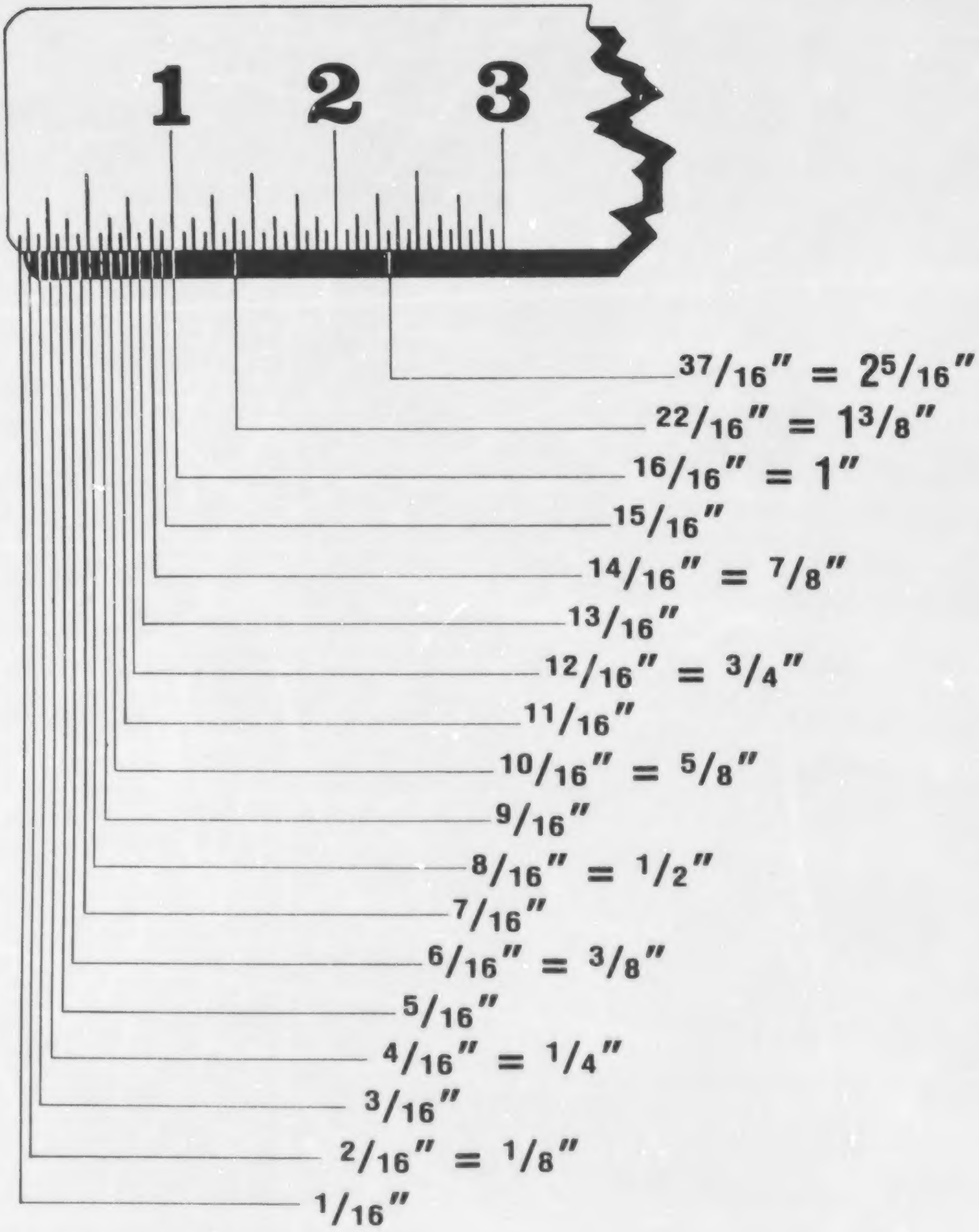
TM #4

BLC - 177-B

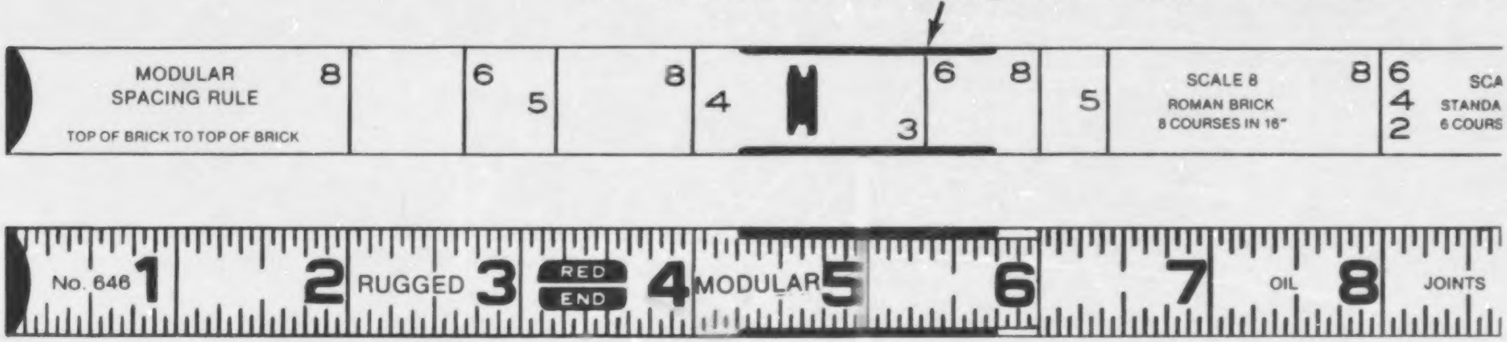
Reading the Eighths Rule


1
2
3
13/8" = 1 5/8"
8/8" = 1"
7/8"
6/8" = 3/4"
5/8"
4/8" = 1/2"
3/8"
2/8" = 1/4"
1/8"

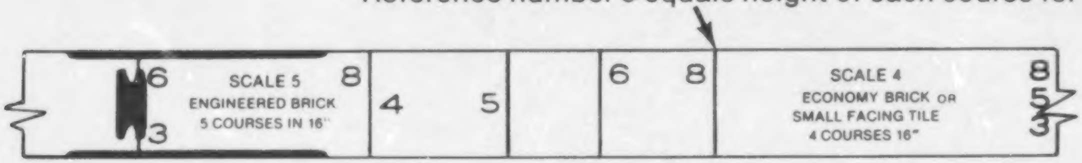
Reading the Sixteenths Rule


1
2
3
37/16" = 2 5/16"
22/16" = 1 3/8"
16/16" = 1"
15/16"
14/16" = 7/8"
13/16"
12/16" = 3/4"
11/16"
10/16" = 5/8"
9/16"
8/16" = 1/2"
7/16"
6/16" = 3/8"
5/16"
4/16" = 1/4"
3/16"
2/16" = 1/8"
1/16"

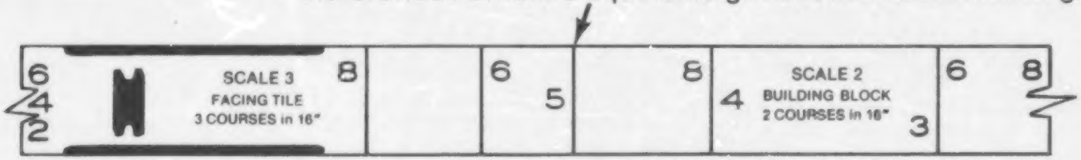
Reading the Modular Rule


MODULAR
SPACING RULE
TOP OF BRICK TO TOP OF BRICK
SCALE 8
ROMAN BRICK
8 COURSES IN 16"
SCA
STANDA
6 COURS
No. 646
RUGGED
RED
END
MODULAR
OIL
JOINTS

Reference number 6 equals height of each course for standard bricks.

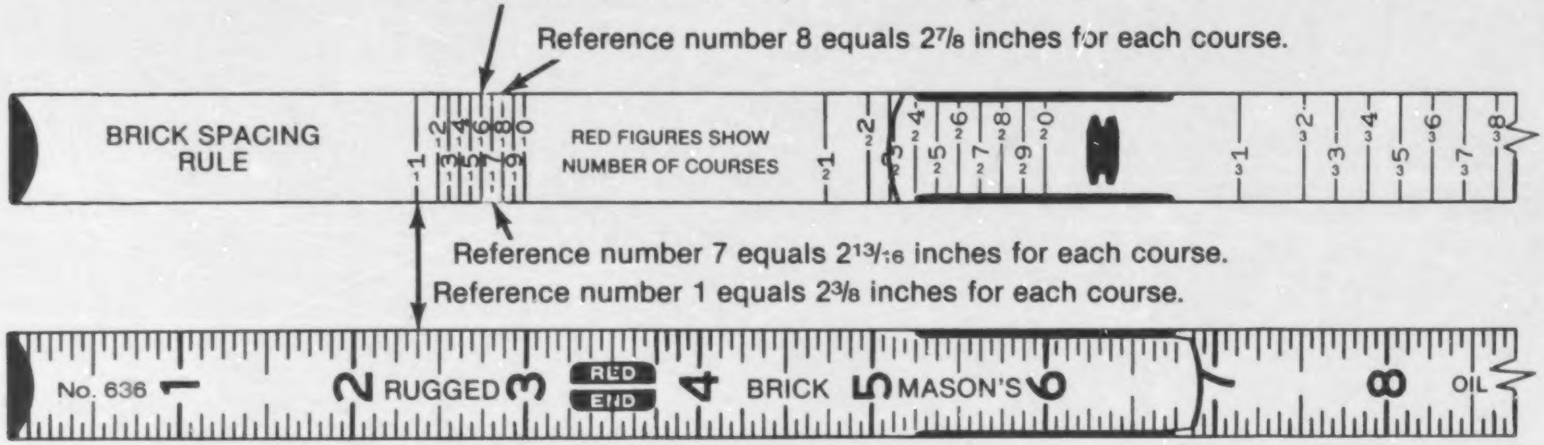

SCALE 5
ENGINEERED BRICK
5 COURSES IN 16"
SCALE 4
ECONOMY BRICK OR
SMALL FACING TILE
4 COURSES 16"

Reference number 8 equals height of each course for Roman bricks.


SCALE 3
FACING TILE
3 COURSES in 16"
SCALE 2
BUILDING BLOCK
2 COURSES in 16"

Reference number 5 equals height of each course for engineered bricks.

Reading the Spacing Rule


BRICK SPACING RULE
RED FIGURES SHOW NUMBER OF COURSES
No. 636
RUGGED
RED END
BRICK
MASON'S
OIL

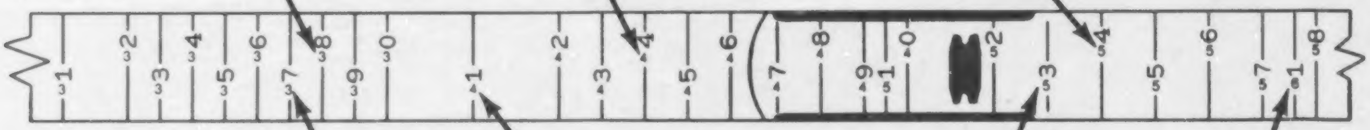
Reference number 6 equals 2¾ inches for each course.

Reference number 8 equals 2⅞ inches for each course.

Reference number 7 equals 2¹³⁄₁₆ inches for each course.

Reference number 1 equals 2⅜ inches for each course.

Red Figures Show Number of Courses



Three Courses

Four Courses

Five Courses

Three Courses

Four Courses

Five Courses

Six Courses

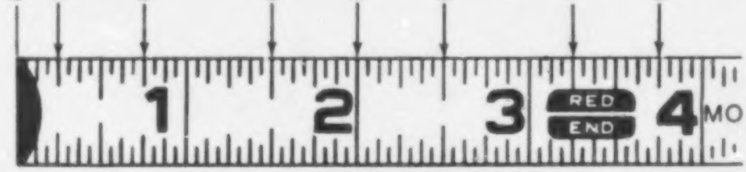
MEASURING
UNIT II

ASSIGNMENT SHEET #1 — READ MEASUREMENTS ON A RULE

NAME ______________________________ SCORE ____________

Reading measurements on a rule is a basic bricklaying skill. Bricklayers should practice this skill until they can quickly and accurately read all types of rules used in the trade.

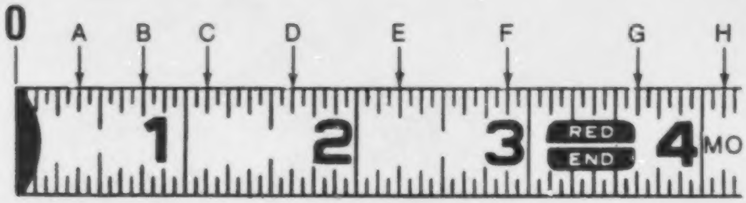
A. Read to the nearest ¼ inch the rule in the drawing below. Write your answers in the blanks provided.



1. 0 to A = ____________
2. 0 to B = ____________
3. 0 to C = ____________
4. 0 to D = ____________
5. 0 to E = ____________
6. A to C = ____________
7. B to D = ____________
8. C to E = ____________
9. D to F = ____________
10. B to G = ____________

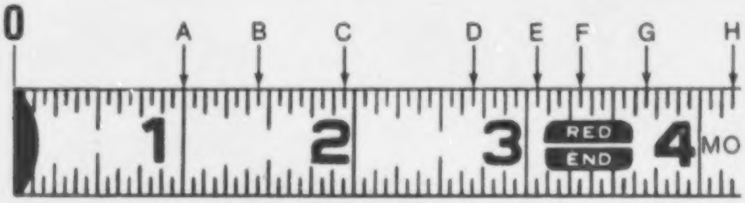
ASSIGNMENT SHEET #1

B. Read to the nearest 1/8 inch the rule in the drawing below. Write your answers in the blanks provided.


0
A
B
C
D
E
F
G
H
1
2
3
RED END
4
MO

1. 0 to A = ______________
2. 0 to B = ______________
3. 0 to C = ______________
4. 0 to D = ______________
5. 0 to E = ______________
6. A to D = ______________
7. C to F = ______________
8. B to E = ______________
9. E to H = ______________
10. G to H = ______________

C. Read to the nearest 1/16 inch the rule in the drawing below. Write your answers in the blanks provided.


0
A
B
C
D
E
F
G
H
1
2
3
RED END
4
MO

1. 0 to A = ______________
2. 0 to B = ______________
3. 0 to C = ______________
4. 0 to D = ______________
5. A to E = ______________
6. B to F = ______________
7. C to E = ______________
8. D to F = ______________
9. G to H = ______________
10. C to H = ______________

MEASURING
UNIT II

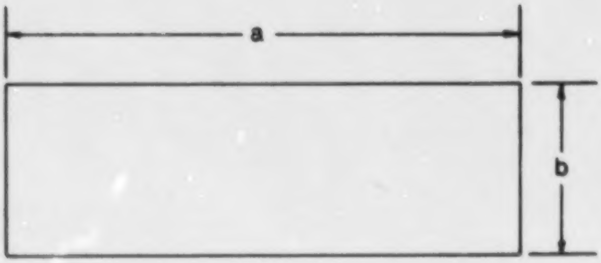
ASSIGNMENT SHEET #2 — MEASURE OBJECTS

NAME ______________________________ SCORE ______________

Measuring objects is a basic bricklaying skill. Bricklayers should practice this skill until they can quickly and accurately measure various objects encountered in the bricklaying trade.

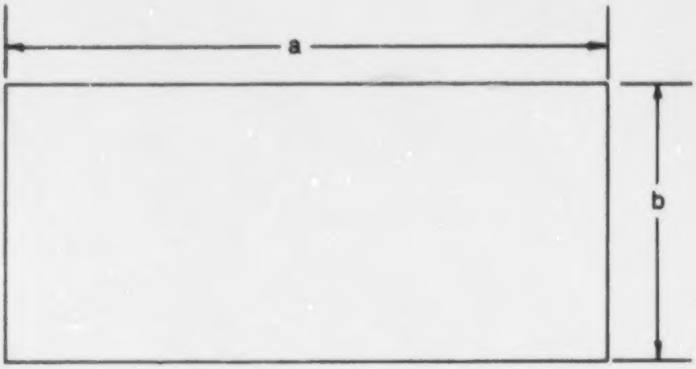
Using a rule graduated to 1/16 of an inch, measure the following objects.

A.



1. Length = ______________
2. Height = ______________

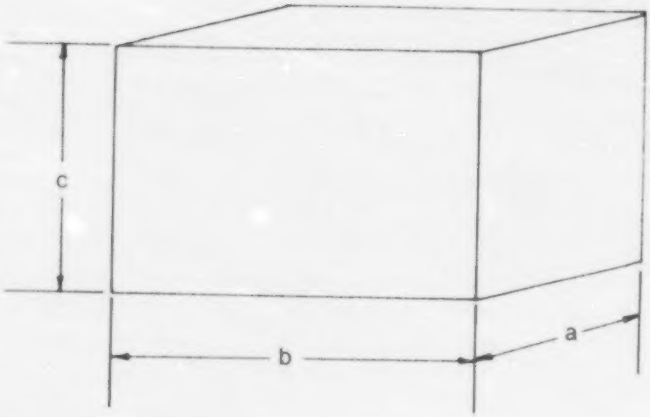
B.



1. Length = ______________
2. Height = ______________

ASSIGNMENT SHEET #2

C.

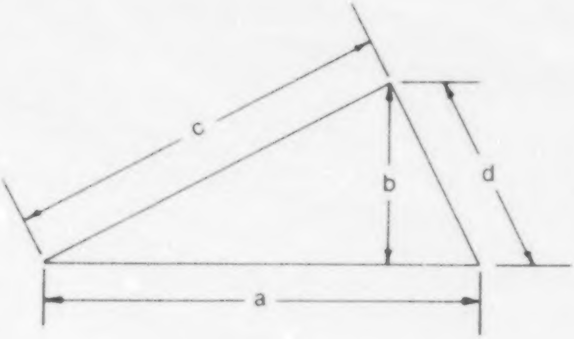


1. Width = ______________

2. Length = ______________

3. Height = ______________

D.



1. Base = ______________

2. Height = ______________

3. Slope c = ______________

4. Slope d = ______________

MEASURING
UNIT II

ASSIGNMENT SHEET #3 — DRAW LINES AND OBJECTS TO SPECIFIED DIMENSIONS

NAME ________________________________ SCORE ______________

The bricklayer must be able to draw lines and objects to proper or given dimensions. This skill is necessary for plan drawing and specifications.

Using a rule graduated to 1/16 inch, draw the following lines and objects to the given dimensions.

A. In the space provided, draw straight lines to the following lengths:

1. 3 3/4 inches

2. 2 1/16 inches

3. 3 5/8 inches

4. 1 1/4 inches

5. 2 7/16 inches

B. In the space below, draw a rectangle with a length of 2 3/16 inches and a height of 1 7/8 inches.

ASSIGNMENT SHEET #3

C. In the space below, draw a triangle with a base length of 2 5/8 inches, a height of 1 1/4 inches, and one slope of 2 5/16 inches.

MEASURING
UNIT II

ASSIGNMENT SHEET #4 — MARK COURSE HEIGHT ON A STORY POLE, USING A MODULAR SPACING RULE

NAME ____ SCORE ________________

The modular spacing rule is designed to save the bricklayer time. A qualified bricklayer should be able to read a modular spacing rule and mark a story pole.

Using a modular spacing rule, determine the layout of a story pole for the following situations. Mark story poles and ask instructor to evaluate them.

A. Specifications call for use of Roman bricks. How many courses will be needed to build a wall 54 inches high?

Courses = ____________________

B. Mark a story pole using engineered bricks. What is the course height?

Course height = ____________________

C. Mark a story pole using modular bricks with reference number 6. How many courses of bricks will be needed for a wall height of 48 inches?

Courses = ____________________

D. You are asked to build a wall 8 feet 8 inches tall. How many courses of concrete block (8" × 8" × 16") will be needed to complete the wall?

Courses = ____________________

E. Mark a story pole using a nonmodular brick. How many courses of bricks will be needed for a wall height of 41 inches?

Courses = ____________________

MEASURING
UNIT II

ASSIGNMENT SHEET #5 — MARK COURSE HEIGHT ON A STORY POLE, USING A BRICK SPACING RULE

NAME ______________________________ SCORE ____________

The brick spacing rule is designed to measure course heights and save the bricklayer time. A qualified bricklayer should be able to read the brick spacing rule and mark a story pole.

Using a brick spacing rule, determine the layout of a story pole for the following situations.

A. The plan and specifications call for sixteen courses at 2 11/16 inches for 43 inches. Using the spacing rule, what reference number should be used for marking the story pole?

Reference number = ________________

Mark a story pole and turn in for evaluation.

B. The plan and specifications call for twelve courses of bricks for 31 1/2 inches. What reference number should be used for marking the story pole?

Reference number = ________________

Mark story pole and turn in for evaluation.

C. You are asked to build a brick wall 33 inches high with a course height of 4-11.

(NOTE: 4-11 designates four courses of brick in 11 inches.)

1. How many courses will be required?

   Courses = __________

2. What reference number or spacing scale should be used to mark the story pole?

   Reference number/spacing scale = __________

D. Specifications call for twenty-eight courses of brick for 70 inches.

1. What reference number should be used for marking the story pole?

   Reference number = __________

2. What size bricks would be used?

   Brick size = __________

MEASURING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A.
1. 1/4 inch
2. 3/4 inch
3. 1 1/2 inches
4. 2 inches
5. 2 1/2 inches
6. 1 1/4 inches
7. 1 1/4 inches
8. 1 inch
9. 1 1/4 inches
10. 3 inches

B.
1. 3/8 inch
2. 3/4 inch
3. 1 1/8 inches
4. 1 5/8 inches
5. 2 1/4 inches
6. 1 1/4 inches
7. 1 3/4 inches
8. 1 1/2 inches
9. 1 7/8 inches
10. 1/2 inch

C.
1. 1 inch
2. 1 7/16 inches
3. 1 15/16 inches
4. 2 11/16 inches
5. 2 1/16 inches
6. 1 7/8 inches
7. 1 1/8 inches
8. 5/8 inch
9. 1/2 inch
10. 2 1/4 inches

Assignment Sheet #2

A.
1. 3 inches
2. 1 inch

B.
1. 3 1/2 inches
2. 1 5/8 inches

ANSWERS TO ASSIGNMENT SHEETS

C. 1. 1 inch

2. 2 1/8 inches

3. 1 7/16 inches

D. 1. 2 1/2 inches

2. 1 1/16 inches

3. 2 1/4 inches

4. 1 3/16 inches

Assignment Sheet #3

A. 1. 3 3/4 inches

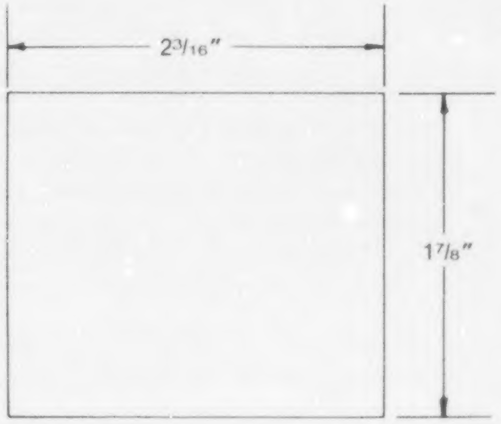
2. 2 1/16 inches

3. 3 5/8 inches

4. 1 1/4 inches

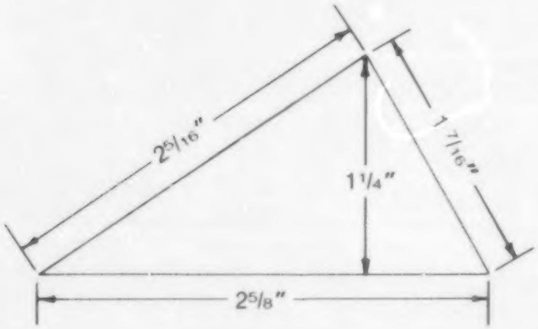
5. 2 7/16 inches

B.



ANSWERS TO ASSIGNMENT SHEETS

C.


2 5/16"
1 1/4"
1 7/16"
2 5/8"

Assignment Sheet #4

A. 27

B. 3 3/16 inches

C. 18

D. 13

E. 16

Assignment Sheet #5

A. #5

B. #4

C.
  1. 12
  2. #6

ANSWERS TO ASSIGNMENT SHEETS

D. 1. #2

2. 2 1/2 inches

MEASURING
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with measuring to their correct definitions. Write the correct numbers in the blanks. Terms and definitions continue on the following page.

_____a. Based on a nominal 4-inch spacing

_____b. Smallest whole unit of linear measure commonly used

_____c. Parts or sections on a rule that make up 1 inch

_____d. First digit to the left of decimal

_____e. Measuring instrument graduated in whole units and fractions of units

_____f. Theoretical size that may vary from the actual size

_____g. Setting limits or bounds according to a predetermined standard

_____h. Relating to, consisting of, or resembling a straight line

_____i. Number of full units and fractions of units between two points

_____j. Part of a whole; represents one or more equal parts of a unit

_____k. Unit of measure consisting of twelve equal parts called inches

_____l. Length of wood marked for course levels and/or course height

_____m. Tool used to establish or check corners and courses of masonry

_____n. Line at right angle to another line or surface

_____o. Distance around the outer edge of a circle

1. Unit
2. Measuring
3. Fraction
4. Modular
5. Corner pole
6. Foot
7. Rule
8. Divisions
9. Dimension
10. Story pole
11. Inch
12. Nominal size
13. Linear
14. Circumference
15. Perpendicular

TEST

_____p. Number of inches for each course of masonry

_____q. Angle formed by two lines perpendicular to each other

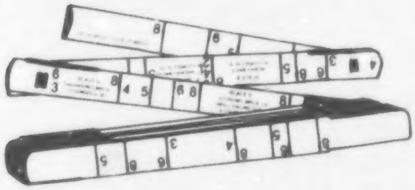
_____r. Figure having three sides and three angles

_____s. Detailed set of written instructions that supplement drawings; describe quality and type of materials and equipment used in structure and become part of contract

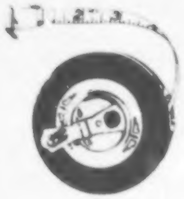
_____t. Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles

16. Right angle
17. Rectangle
18. Spacing
19. Triangle
20. Specifications

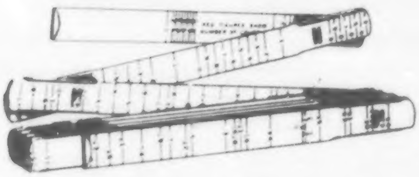
2. Label basic measuring tools used by bricklayers. Write the correct names in the blanks.



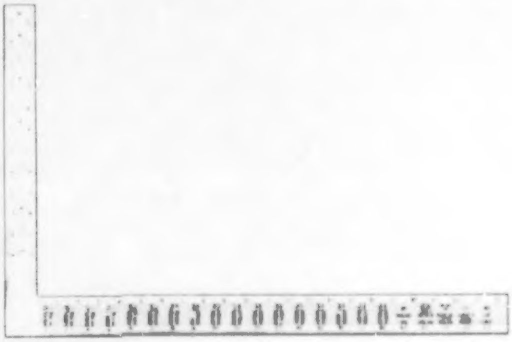
a. ______________________



b. ______________________



c. ______________________



d. ______________________

TEST

3. Distinguish between modular and brick spacing rules. Write an "M" in blanks before modular spacing rules and a "B" in blanks before brick spacing rules.

_____a. All courses (8, 6, 5, 4, 3, and 2) scale out at 16 inches

_____b. Common method of determining spacing for nonmodular brick

_____c. Common method of determining spacing for modular brick and block

_____d. Reverse side has common denominations reading horizontally

_____e. Reverse side has common denominations reading vertically

4. Select from the following list uses of modular and brick spacing rules. Write an "X" in the blank before each correct answer.

_____a. Determining length of brick

_____b. Determining number of courses and course height of designated number of courses in a given height

_____c. Marking story pole or corner pole

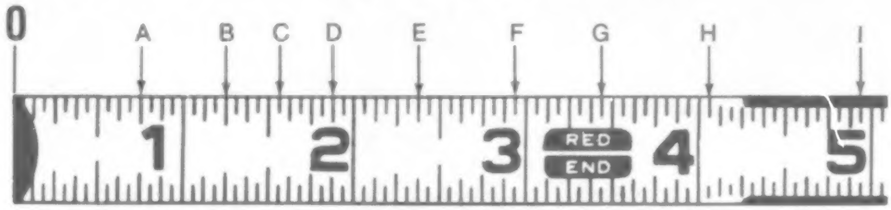
_____d. Measuring height of corner pole

_____e. Determining length of wall

_____f. Determining course height of designated number of modular courses in 16 inches

_____g. Checking dimensions on plans

5. Read to the nearest 1/16 inch the standard rule illustrated below.



a. 0 to H = _____________

b. A to D = _____________

c. B to F = _____________

d. C to I = _____________

e. A to H = _____________

f. F to I = _____________

g. D to H = _____________

h. G to I = _____________

i. D to F = _____________

j. E to H = _____________

TEST

6. Describe procedures for reading modular and brick spacing rules.

   a. Modular spacing rule

      1) ________________

      2) ________________

      3) ________________

      4) ________________

   b. Brick spacing rule

      1) ________________

      2) ________________

      3) ________________

      4) ________________

(NOTE: Test questions 7-11 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

7. Read measurements on a rule.

8. Measure objects.

9. Draw lines and objects to specified dimensions.

10. Mark course height on a story pole, using a modular spacing rule.

11. Mark course height on a story pole, using a brick spacing rule.

MEASURING
UNIT II

ANSWERS TO TEST

1. a. 4
   b. 11
   c. 8
   d. 1
   e. 7
   f. 12
   g. 2
   h. 13
   i. 9
   j. 3
   k. 6
   l. 10
   m. 5
   n. 15
   o. 14
   p. 18
   q. 16
   r. 19
   s. 20
   t. 17

2. a. Modular spacing rule
   b. Steel tape
   c. Brick spacing rule
   d. Steel framing square

3. a. M
   b. B
   c. M
   d. M
   e. B

4. b, c, f

5. a. 4 1/16 inches
   b. 1 1/8 inches
   c. 1 11/16 inches
   d. 3 3/8 inches
   e. 3 5/16 inches
   f. 2 inches
   g. 2 3/16 inches
   h. 1 1/2 inches
   i. 1 1/16 inches
   j. 1 11/16 inches

6. Description should include the following
   a. Modular spacing rule
      1) Check specifications to determine course height and/or size of bricks

ANSWERS TO TEST

    2) Determine number of courses in 16 inches
    3) Read each reference number
    4) Transcribe reference number to standard rule to determine exact course height

  b. Brick spacing rule

    1) Check specifications to determine course height and/or size of bricks
    2) Determine height to be filled
    3) Transcribe wall height to spacing rule
    4) Read each reference number to determine course height

7. Evaluated to the satisfaction of the instructor

8. Evaluated to the satisfaction of the instructor

9. Evaluated to the satisfaction of the instructor

10. Evaluated to the satisfaction of the instructor

11. Evaluated to the satisfaction of the instructor

BASIC PLAN READING
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to identify types of drawings and architectural symbols. The student should also be able to read and use an architect's scale. The student will show this knowledge by completing the assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Define *plan*.
2. Define *construction drawings*.
3. Match terms associated with basic plan reading to their correct definitions.
4. Name types of pictorial drawings.
5. Label types of construction plans.
6. Distinguish among types of construction drawings according to characteristics.
7. Describe divisions found in a set of building plans.
8. Label types of lines included in the alphabet of lines.
9. Match types of lines to their correct descriptions.
10. Label architectural symbols for floor plans and sectioning.
11. Label architectural symbols for elevations, exterior walls, and floor finishes.
12. Match abbreviations commonly used on plans to their correct names.
13. State rules for reading an architect's scale.
14. Select from a list common scales to which plans are drawn.
15. Read an architect's scale.
16. List items found on structural drawings.
17. List major items that may be covered in a set of masonry specifications.

OBJECTIVE SHEET

18. Name items that may be shown in detail on drawings.
19. Read an architectural plan.
20. Read a structural plan.
21. Read a floor plan.
22. Interpret a set of masonry specifications.
23. Interpret a finish schedule.

BASIC PLAN READING
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Obtain transparencies.

  (NOTE: Transparencies are available from AGC and CIMC.)

  B. Provide students with objective sheet.

  C. Discuss unit and specific objectives.

  D. Provide students with information and assignment sheets.

  E. Discuss information and assignment sheets.

  F. Provide students with examples of types of pictorial drawings and types of period construction.

  G. Give test.

  H. Complete appropriate section of competency profiles.

  (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

  A. Objective sheet

  B. Suggested activities

  C. Information sheet

  D. Transparency masters

    1. TM #1 — Alphabet of Lines

    2. TM #2 — Alphabet of Lines (Continued)

    3. TM #3 — Architect's Scale

    4. TM #4 — Comparison of Scales

  E. Assignment sheets

    1. Assignment Sheet #1 — Read the Architect's Scale Using Scale 12" = 1' - 0"

    2. Assignment Sheet #2 — Read the Architect's Scale Using Scale 1 1/2" = 1' - 0"

SUGGESTED ACTIVITIES

3. Assignment Sheet #3 — Read the Architect's Scale Using Scale 1/2" = 1' - 0"

4. Assignment Sheet #4 — Read the Architect's Scale Using Scale 1/4" = 1' - 0"

5. Assignment Sheet #5 — Read the Architect's Scale Using Scale 1/8" = 1' - 0"

6. Assignment Sheet #6 — Read Architectural Plans

7. Assignment Sheet #7 — Read a Structural Plan

8. Assignment Sheet #8 — Read a Floor Plan

9. Assignment Sheet #9 — Interpret a Set of Masonry Specifications

10. Assignment Sheet #10 — Interpret a Finish Schedule

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Hendrix, Laborn J. "Bud." *Millwright Instructional Materials.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1980.

B. Hepler, Donald E., and Paul I. Wallach. *Architecture Drafting and Design,* 3rd ed. New York: McGraw-Hill, 1977.

C. Masonry Institute of Wisconsin. *Masonry Guide Specifications.* Millwaukee, Wisconsin: 1981.

D. Ramsey, Charles G., and Harold R. Sleeper. *Architectural Graphic Standards,* 6th ed. New York: John Wiley and Sons, Inc., 1970.

E. Turcotte, Raymond J. *Bricklaying Curriculum.* Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1977.

BASIC PLAN READING
UNIT III

INFORMATION SHEET

I. Plan — Architectural drawing, such as a floor plan, that shows a horizontal view of a structure; may be black on white or white on blue

II. Construction drawings — Set of detailed drawings prepared by an architect from which plans are reproduced, based on information from owner; contain all information and dimensions necessary to complete a job successfully

III. Terms and definitions

A. Alphabet of lines — Set of conventional symbols covering all lines used in drawings

B. Architect's scale — Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

EXAMPLES: 1/16", 1/8", 1/4", 3/8", 1/2", 3/4", 1", 1 1/2", or 3" is equal to one foot.

C. Architectural drawing — Graphic representation shown with lines and symbols

D. Blueprints — Reproductions of architect's drawings

E. Corbel — Stepped out courses in a wall that form a ledge; projection of stone or brick from face of wall

F. Course — Continuous horizontal layer of units, bonded with mortar

G. Detail — Drawing that shows complete detailed information for an element of construction

H. Dimensions — Arrangement of lines and figures indicating actual size of the object represented

I. Elevation — Drawing representing the front, side, or rear face of a structure, indicating what the building will look like when it is completed

J. Grouting — Process of filling masonry units and between units with a cement and sand mixture to help strengthen units

(NOTE: Sometimes grouting must be done in stages or lifts.)

K. Head detail — Enlarged section drawing of top of a door or window frame

INFORMATION SHEET

L. Jamb detail — Enlarged section drawing of side of a door or window frame

M. Parging — Plastering masonry walls with mortar

N. Scale drawing — Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

O. Schedule — Chart of materials and products

P. Section — Drawing representing an object that has been cut to show internal construction

Q. Sill detail — Enlarged section drawing of bottom of a door or window

R. Specifications — Detailed set of written instructions that supplements the drawings; describes material and equipment used in the structure as to quality and type, and becomes part of the contract

(NOTE: Construction drawings plus the specifications are called *construction documents.*)

S. Staging — Sequential grouting in separate steps or stages rather than grouting the entire length at once

T. Symbol — Sign that has been standardized and is used to represent an object or material

IV. Types of pictorial drawings

(NOTE: Pictures of buildings make it easy to understand what the building looks like and are helpful in learning how to read blueprints.)

A. Perspective

B. Isometric

C. Oblique

D. Three view (orthographic projection)

V. Types of construction plans (Sheets #1-#12)

(NOTE: Sheets #1 - #12 are on the following pages.)

A. Plot plan (Sheet #1)

B. Foundation plan (Sheet #2)

INFORMATION SHEET

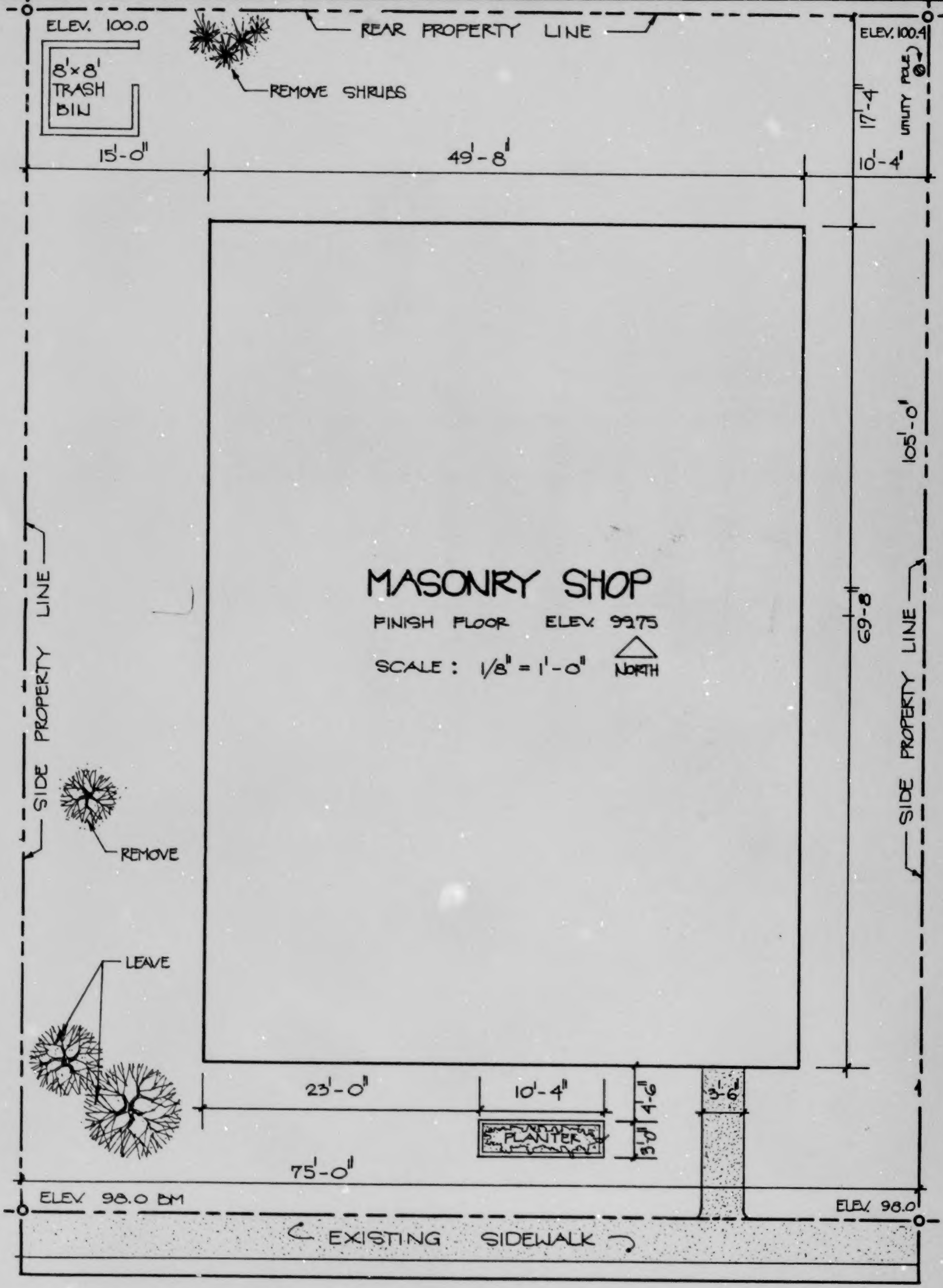
C. Floor plan (Sheet #3)

D. Elevations (Sheets #4 and #5)

E. Section drawings (Sheets #6 - #8)

F. Details (Sheets #9 - #11)

G. Schedules (Sheet #12)

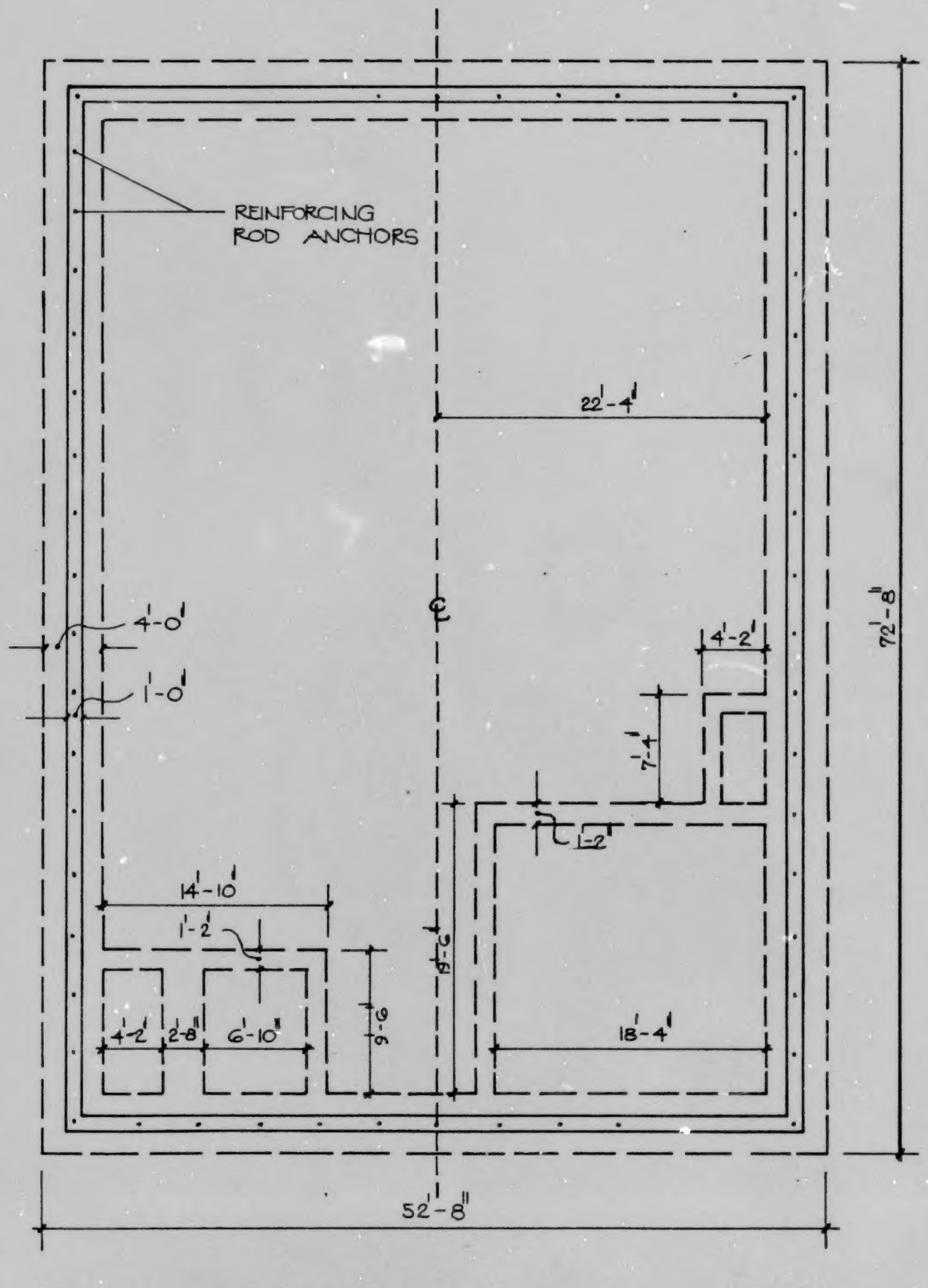

ELEV. 100.0
8'×8' TRASH BIN
REMOVE SHRUBS
REAR PROPERTY LINE
ELEV. 100.4
UTILITY POLE
17'-4"
10'-4'
15'-0"
49'-8"
SIDE PROPERTY LINE
MASONRY SHOP
FINISH FLOOR ELEV. 99.75
SCALE : 1/8" = 1'-0"
NORTH
105'-0"
69'-8
SIDE PROPERTY LINE
REMOVE
LEAVE
23'-0"
10'-4"
4'-6"
3'-6"
PLANTER
3'-0"
75'-0"
ELEV. 98.0 BM
ELEV. 98.0
EXISTING SIDEWALK

INFORMATION SHEET

BLC - 217-B

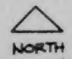
Sheet #1

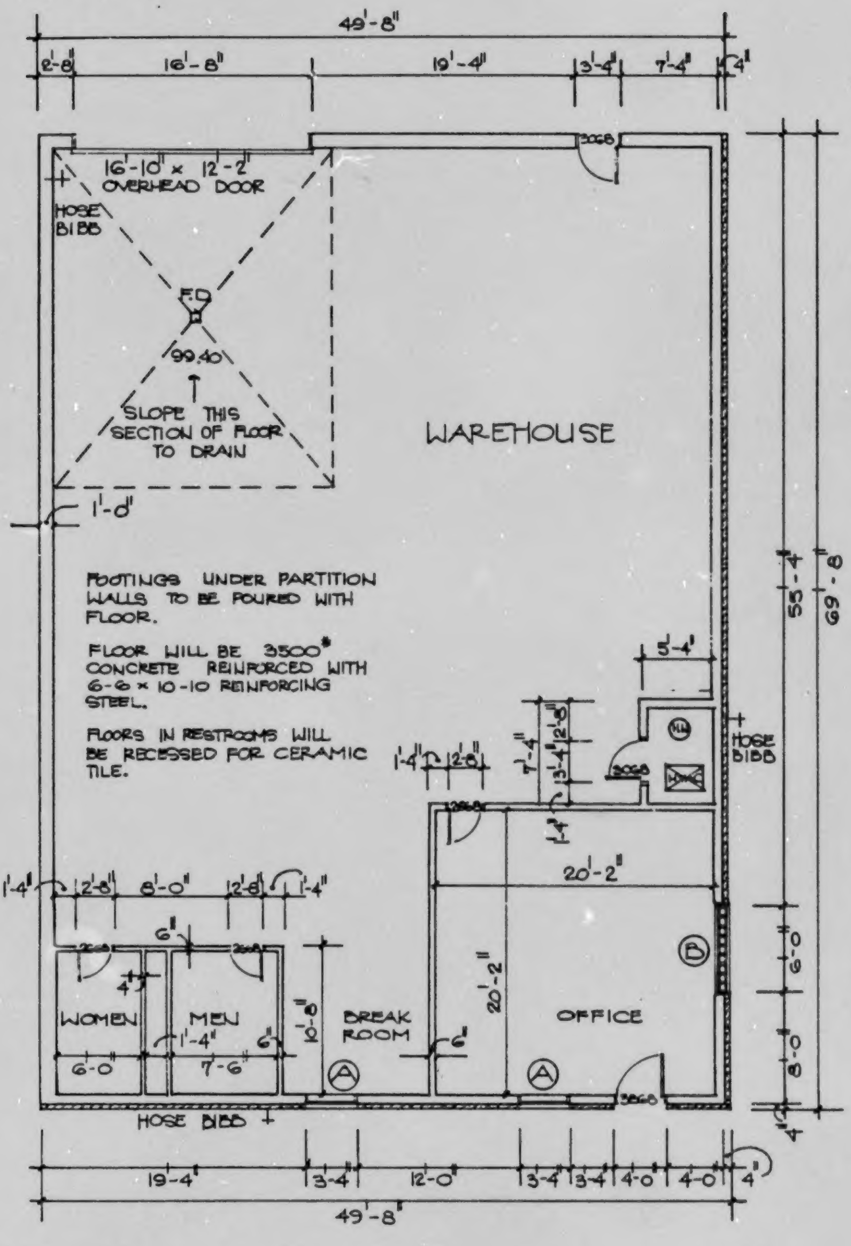
PLOT PLAN


REINFORCING
ROD ANCHORS
22'-4"
℄
4'-0"
1'-0"
4'-2"
7'-4"
1'-2"
14'-10"
1'-2"
9'-6"
4'-6"
4'-2"
2'-8"
6'-10"
18'-4"
72'-8"
52'-8"

FOUNDATION PLAN

SCALE: 1/8" = 1'-0"

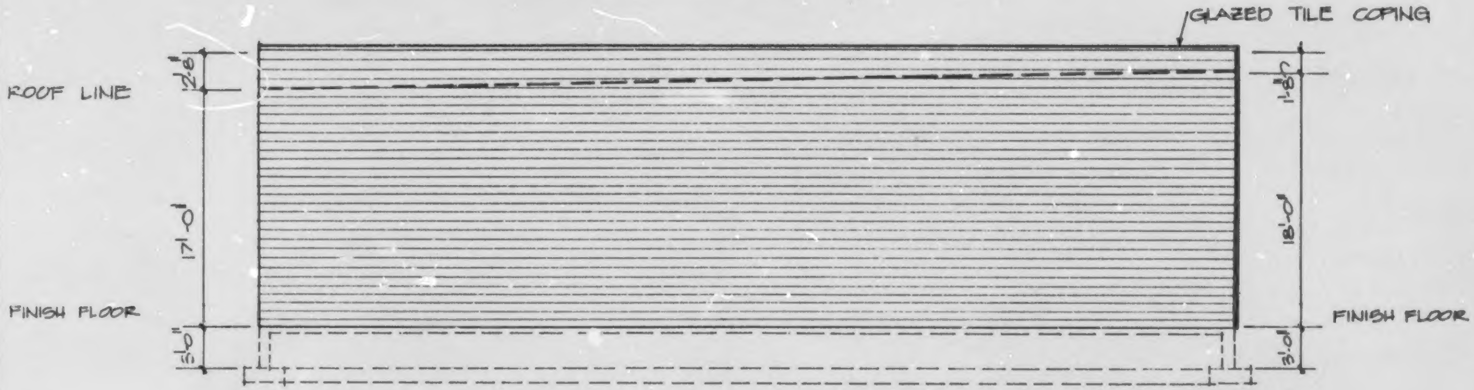



49'-8"
2'-8"
16'-8"
19'-4"
3'-4"
7'-4"
4"
3068
16'-10" × 12'-2"
OVERHEAD DOOR
HOSE BIBB
F.D.
99.40
SLOPE THIS SECTION OF FLOOR TO DRAIN
WAREHOUSE
1'-0"
FOOTINGS UNDER PARTITION WALLS TO BE POURED WITH FLOOR.
FLOOR WILL BE 3500# CONCRETE REINFORCED WITH 6-6 × 10-10 REINFORCING STEEL.
FLOORS IN RESTROOMS WILL BE RECESSED FOR CERAMIC TILE.
5'-4"
W.H.
HOSE BIBB
3068
1'-4"
2'-8"
7'-4"
12'-8"
13'-4"
1'-4"
2868
20'-2"
1'-4"
2'-8"
8'-0"
2'-8"
1'-4"
6"
2068
2068
4"
WOMEN
MEN
1'-4"
6"
10'-0"
BREAK ROOM
6"
20'-2"
OFFICE
B
A
A
3068
6'-0"
7'-6"
HOSE BIBB
55'-4"
69'-8"
6'-0"
8'-0"
4"
19'-4"
3'-4"
12'-0"
3'-4"
3'-4"
4'-0
4'-0
4"
49'-8"
NORTH

FLOOR PLAN

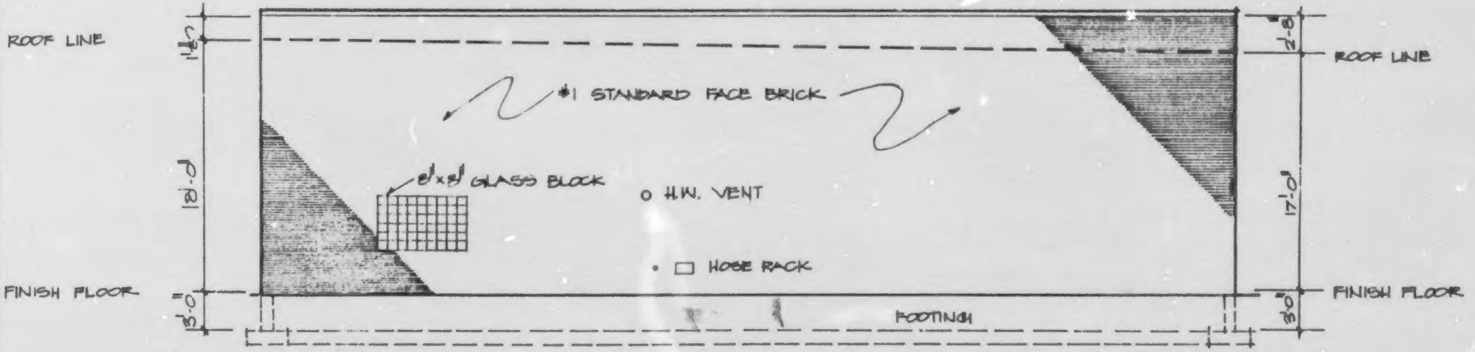
SCALE: 1/8" = 1'-0"

ELEVATIONS


GLAZED TILE COPING
ROOF LINE
2'-8"
17'-0"
FINISH FLOOR
3'-0"
1'-8"
18'-0"
FINISH FLOOR
3'-0"

WEST ELEVATION

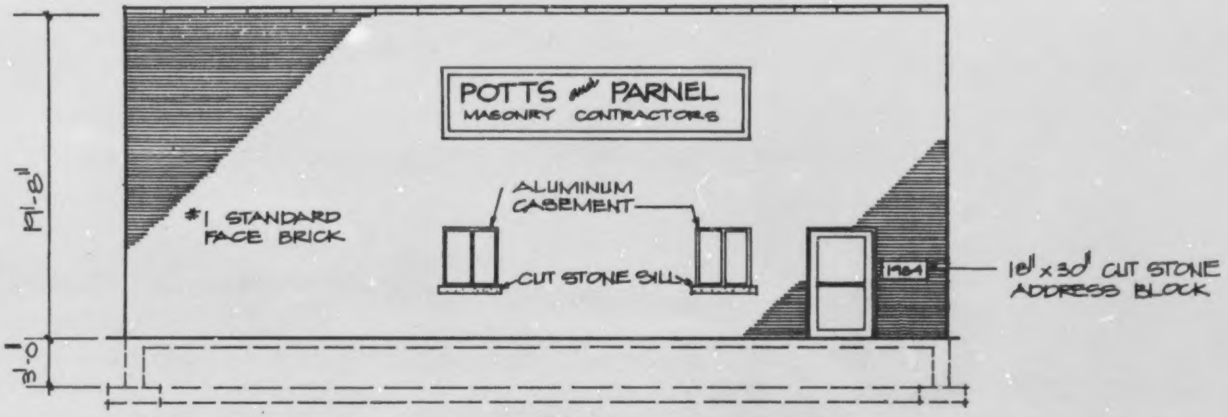
SCALE: 1/8" = 1'-0"


ROOF LINE
1'-8"
18'-0"
FINISH FLOOR
3'-0"
#1 STANDARD FACE BRICK
8"x8" GLASS BLOCK
H.W. VENT
HOSE RACK
FOOTING
2'-8"
ROOF LINE
17'-0"
FINISH FLOOR
3'-0"

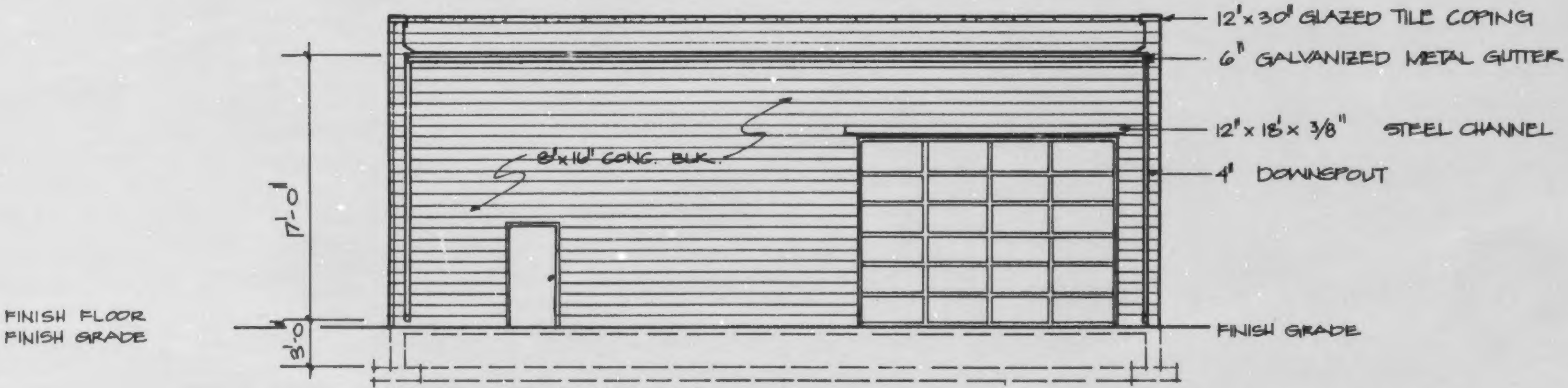
EAST ELEVATION

SCALE: 1/8" = 1'-0"

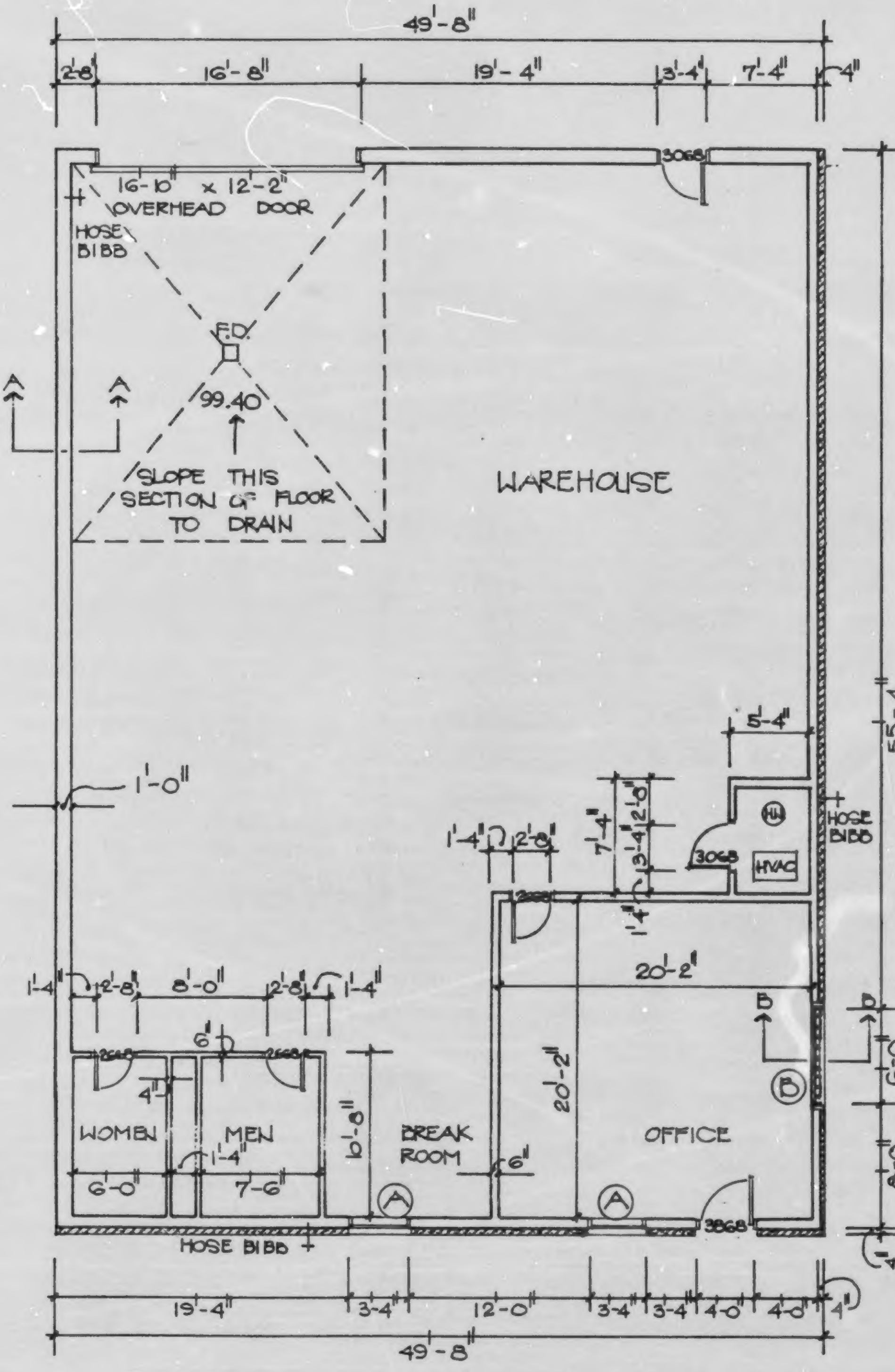
ELEVATIONS
(CONTINUED)


19'-8"
3'-0
#1 STANDARD FACE BRICK
POTTS and PARNEL
MASONRY CONTRACTORS
ALUMINUM CASEMENT
CUT STONE SILL
1984
18" x 30" CUT STONE ADDRESS BLOCK

SOUTH ELEVATION
SCALE: 1/8" = 1'-0"


12"x30" GLAZED TILE COPING
6" GALVANIZED METAL GUTTER
12" x 18' x 3/8" STEEL CHANNEL
4" DOWNSPOUT
8"x16" CONC. BLK.
17'-0"
3'-0
FINISH FLOOR
FINISH GRADE
FINISH GRADE

NORTH ELEVATION
SCALE: 1/8" = 1'-0"

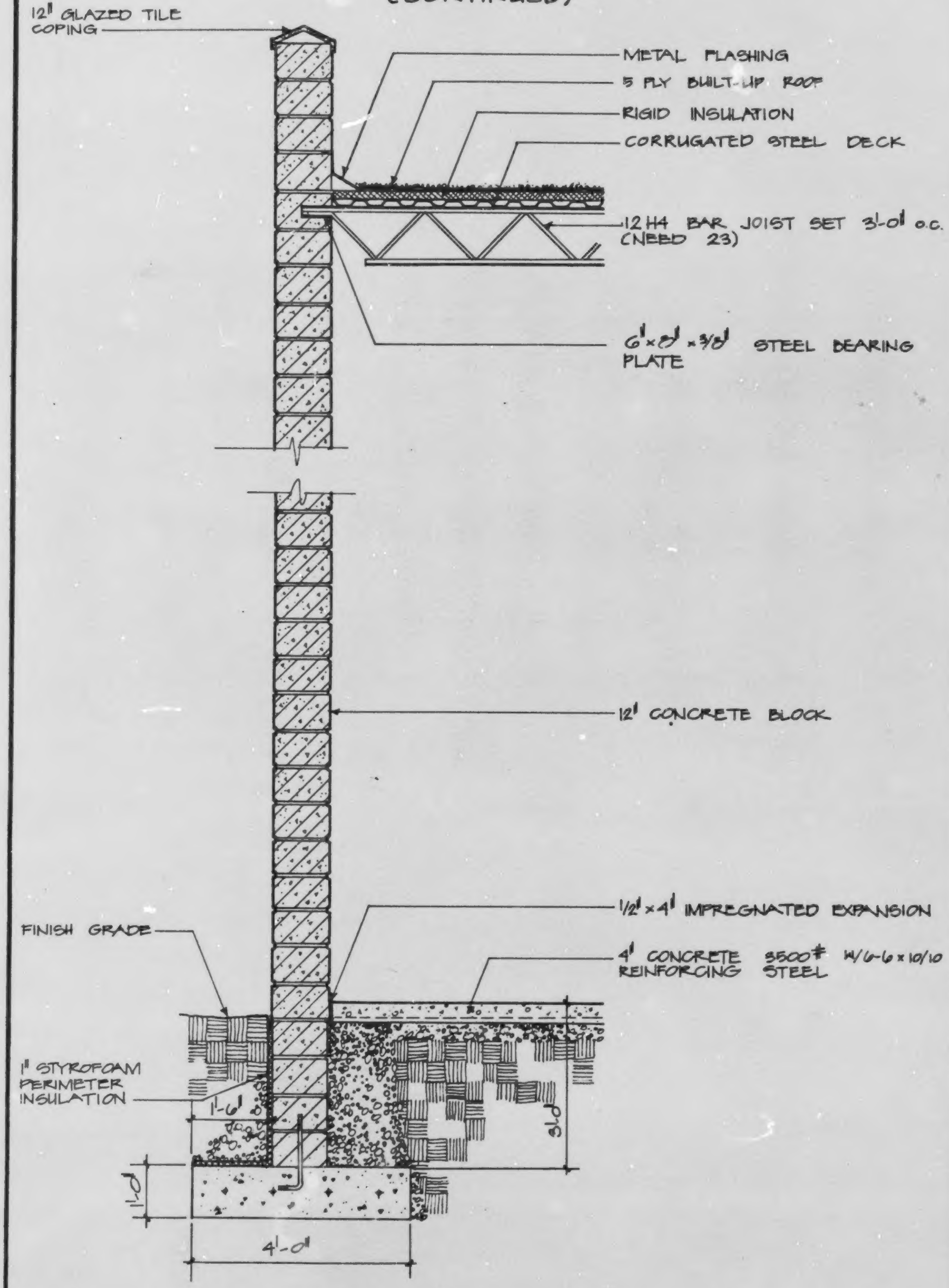

49'-8"
2-8
16'-8"
19'-4"
3'-4"
7'-4"
4"
3068
16-10" x 12'-2"
OVERHEAD DOOR
HOSE BIBB
F.D.
99.40
A
A
SLOPE THIS SECTION OF FLOOR TO DRAIN
WAREHOUSE
55'-4
69'-8
5'-4"
1'-0"
1'-4"
2'-8"
7'-4"
2'-0"
3'-4"
1'-4"
3068
HW
HVAC
HOSE BIBB
2668
20'-2"
B
B
B
6'-0
8'-0
20'-2"
OFFICE
1'-4"
2'-8"
8'-0"
2'-8"
1'-4"
6"
2668
2668
4"
WOMEN
MEN
1'-4"
6'-0"
7'-6"
10'-8"
BREAK ROOM
6"
A
A
3868
4"
HOSE BIBB
19'-4"
3'-4"
12'-0"
3'-4
3'-4
4'-0
4'-0
4"
49'-8"

SECTION DRAWING

NORTH

SCALE: 1/8" = 1'-0"

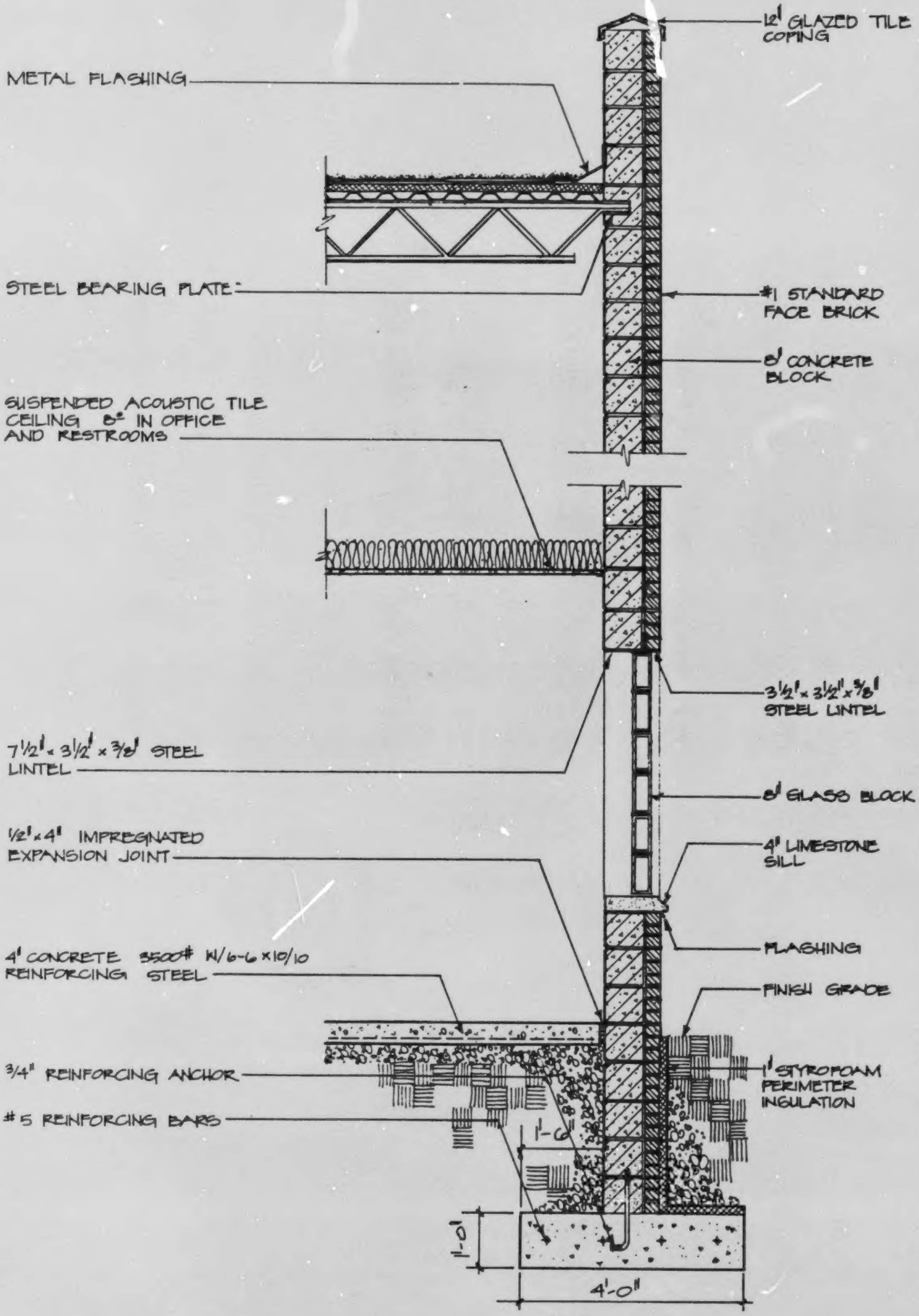
SECTION DRAWING
(CONTINUED)


12" GLAZED TILE COPING
METAL FLASHING
5 PLY BUILT-UP ROOF
RIGID INSULATION
CORRUGATED STEEL DECK
12 H4 BAR JOIST SET 3'-0" o.c. (NEED 23)
6" × 8" × 3/8" STEEL BEARING PLATE
12" CONCRETE BLOCK
1/2" × 4" IMPREGNATED EXPANSION
4" CONCRETE 3500# W/6-6 × 10/10 REINFORCING STEEL
FINISH GRADE
1" STYROFOAM PERIMETER INSULATION
1'-6"
3'-0"
1'-0"
4'-0"

SECTION AA

SCALE: 1/2" = 1'-0"

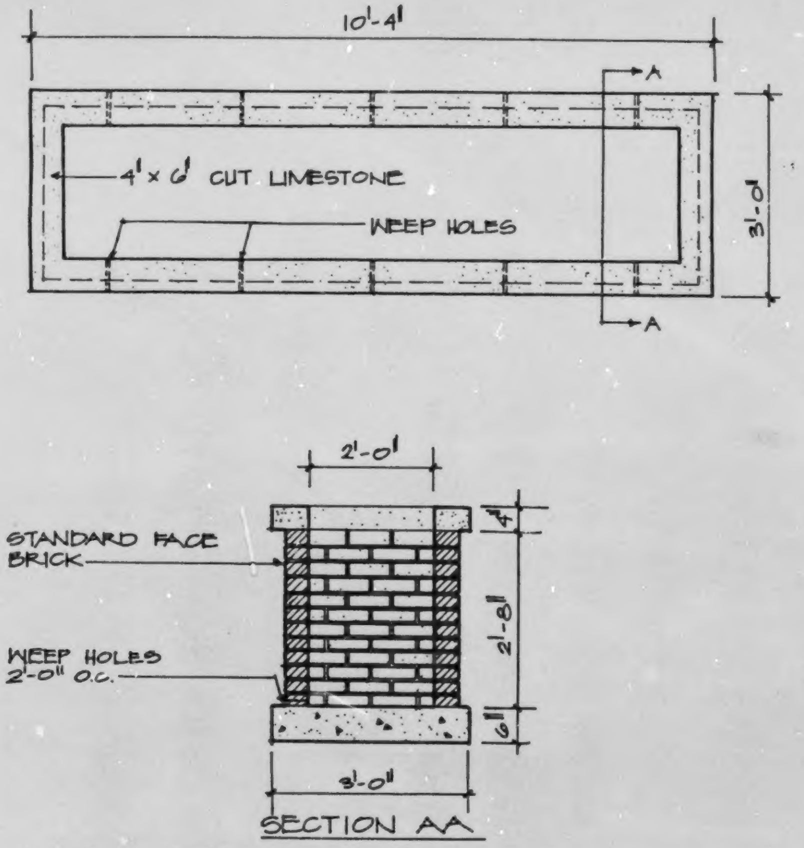
SECTION DRAWING
(CONTINUED)



12' GLAZED TILE COPING
METAL FLASHING
STEEL BEARING PLATE
#1 STANDARD FACE BRICK
8' CONCRETE BLOCK
SUSPENDED ACOUSTIC TILE CEILING 8' IN OFFICE AND RESTROOMS
3½' x 3½" x ⅜' STEEL LINTEL
7½' x 3½' x ⅜' STEEL LINTEL
8' GLASS BLOCK
½' x 4' IMPREGNATED EXPANSION JOINT
4' LIMESTONE SILL
FLASHING
4' CONCRETE 3500# W/6-6 x10/10 REINFORCING STEEL
FINISH GRADE
¾" REINFORCING ANCHOR
1' STYROFOAM PERIMETER INSULATION
#5 REINFORCING BARS
1'-6"
1'-0"
4'-0"

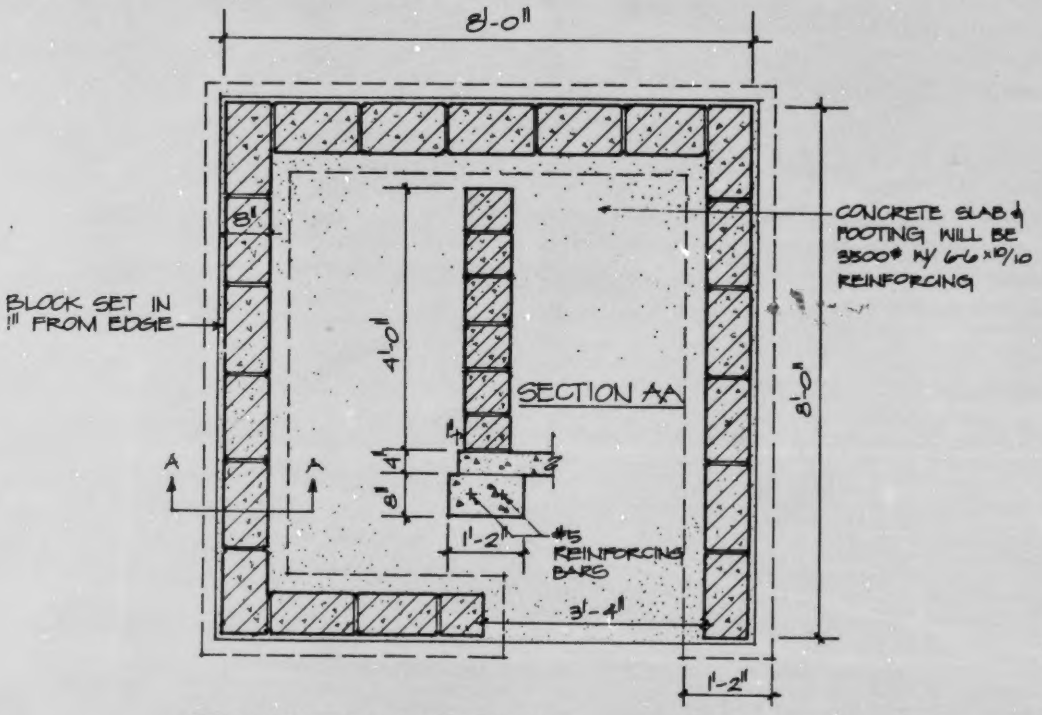
SECTION BB

SCALE: ½' = 1'-0'


10'-4'
A
A
4' × 6' CUT LIMESTONE
WEEP HOLES
3'-0'
2'-0'
4'
STANDARD FACE BRICK
2'-8"
WEEP HOLES 2'-0" O.C.
6"
3'-0"
SECTION AA

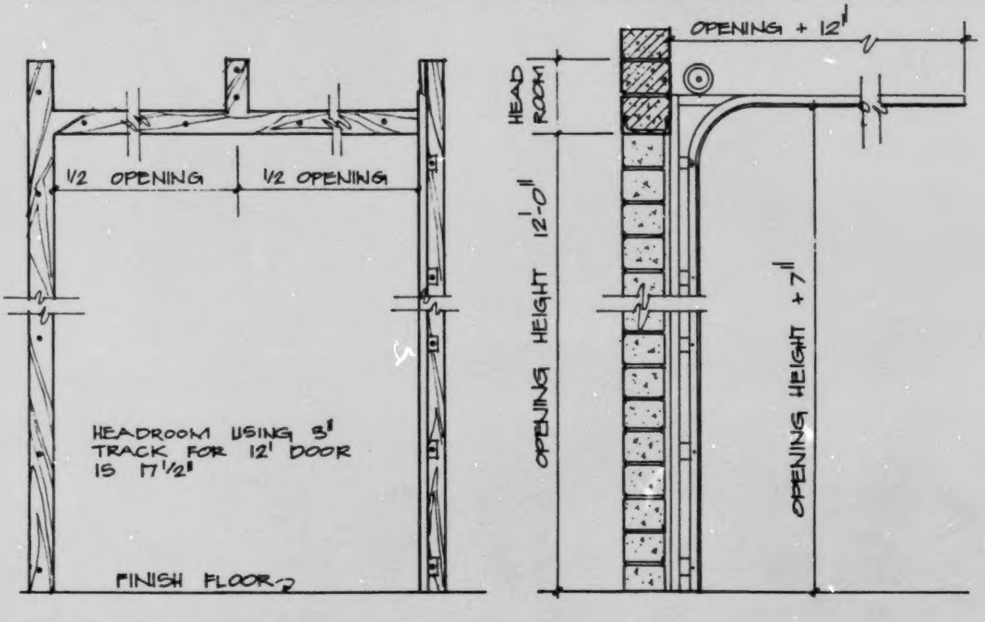
PLANTER DETAILS

SCALE: 1/2" = 1'-0"


8'-0"
8'
CONCRETE SLAB & FOOTING WILL BE 3500# W/ 6-6×10/10 REINFORCING
BLOCK SET IN 1" FROM EDGE
4'-0"
SECTION AA
8'-0"
1"
4"
8"
A
A
1'-2"
#5 REINFORCING BARS
3'-4"
1'-2"

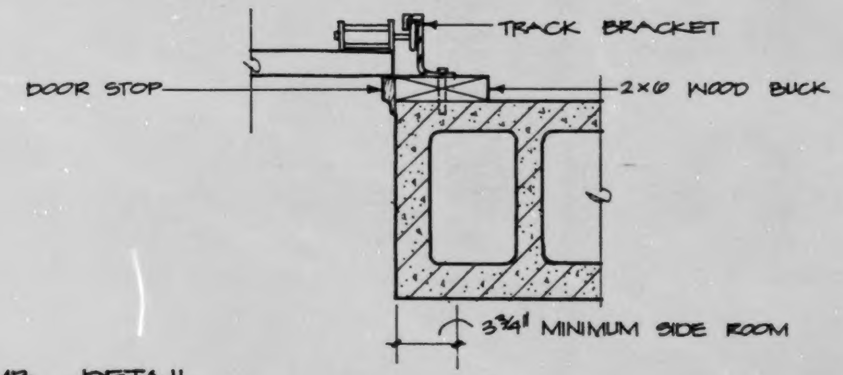
TRASH BIN DETAILS

SCALE: 1/2" = 1'-0"


1/2 OPENING
1/2 OPENING
HEADROOM USING 3' TRACK FOR 12' DOOR IS 17 1/2"
FINISH FLOOR
HEAD ROOM
OPENING HEIGHT 12'-0"
OPENING + 12"
OPENING HEIGHT + 7"

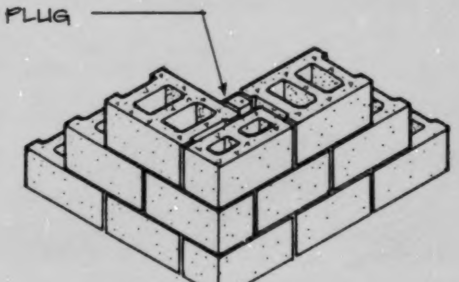
OVERHEAD DOOR

SCALE: 3/8" = 1'-0"


TRACK BRACKET
DOOR STOP
2×6 WOOD BUCK
3 3/4" MINIMUM SIDE ROOM

JAMB DETAIL

SCALE: 1 1/2" = 1'-0"



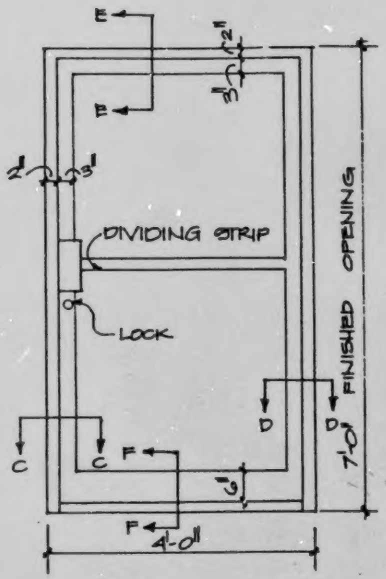
CORNER CONSTRUCTION DETAIL

SCALE: 1/2" = 1'-0"

DETAILS
(CONTINUED)

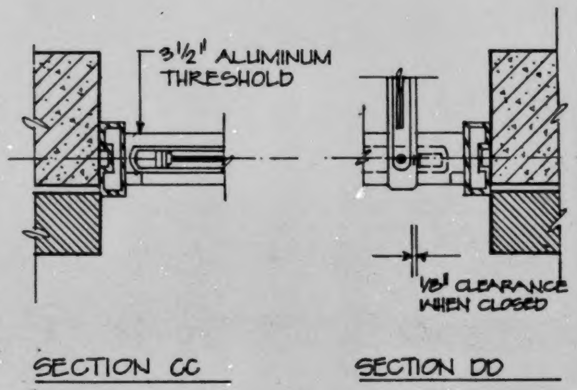
INFORMATION SHEET

BLC - 237-B


E
E
1/2"
3"
2"
3"
DIVIDING STRIP
LOCK
FINISHED OPENING
7'-0"
D
D
C
C
F
F
3"
4'-0"

FRAMED DOOR

SCALE: 1/2" = 1'-0"

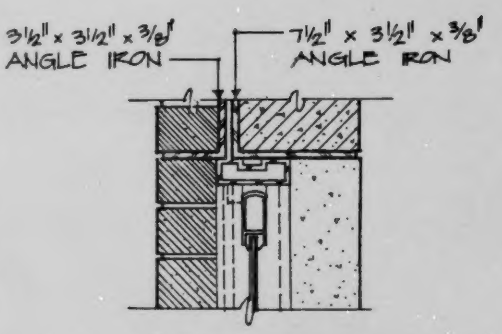

3 1/2" ALUMINUM THRESHOLD
1/8" CLEARANCE WHEN CLOSED

SECTION CC

SECTION DD

DOOR JAMBS

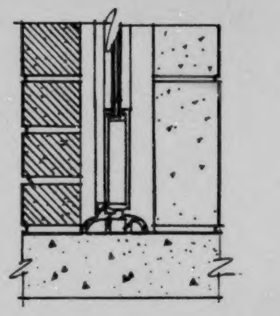
SCALE: 1 1/2" = 1'-0"


3 1/2" x 3 1/2" x 3/8" ANGLE IRON
7 1/2" x 3 1/2" x 3/8" ANGLE IRON

SECTION EE

DOOR HEADER

SCALE: 1 1/2" = 1'-0"



SECTION FF

DOOR SILL

SCALE: 1 1/2" = 1'-0"

DETAILS

(CONTINUED)

SCHEDULES

FINISH SCHEDULE

DOOR SCHEDULE

Symbol	Width	Height	Thickness	Material	Type	Quantity	Threshold	Remarks	Manufacturer
2668	2'-6"	6'-8"	1 3/8"	Wood-with vents	Slab core	3	None	Oil stain	
3068	3'-0"	6'-8"	1 3/8"	Wood-mahogany	Slab core	1	None	Oil stain	
3068	3'-0"	6'-8"	1 3/4"	Metal clad		1	Concrete	Pre-finish	
3868	3'-8"	6'-8"	1 3/4"	Alum & glass	Ins. plate glass	1	Aluminum	None	
Over head	16'-10"	12'-2"				1	None	Oil stain	Clopay Model 900

WINDOW SCHEDULE

Symbol	Width	Height	Screen	Material	Type	Quantity	Remarks	Manufacturer	Catalog number
A	1'-8"	3'-8"	No	Aluminum	Casement	2-double			
B	6'-0"	4'-0"	No	Glass	Glass block	1		Stillburg plate glass	

LINTEL SCHEDULE

Steel	2	3½" x 3½" x 3/8" x 4'-0"
Steel	1 ea.	3½" x 3½" x 3/8" x 4'-8" 3½" x 7½" x 3/8" x 4'-0"
Steel	1 ea.	3½" x 3½" x 3/8" x 6'-8" 3½" x 7½" x 3/8" x 6'-8"
Concrete	3	6" x 8" x 4'-0"
Concrete	2	8" x 8" x 4'-8"
Concrete	1 ea.	6" x 8" x 4'-8" 12" x 8" x 4'-8"
Channel iron and rein. concrete	1	12" x 8" x 18'-0"

ROOM FINISHES

Rooms		Floors			Ceilings				Wall				Base			Trim		Remarks
	CERAMIC TILE	RUBBER TILE	CARPET	CONCRETE	ACOUSTIC TILE	WOOD	NONE		WOOD PANEL	WALL BOARD	WALL PAPER	PAINTED BLOCK	CERAMIC TILE	CERAMIC TILE	WOOD	RUBBER	WOOD	PLASTIC	
Office			✓		✓				✓						✓		✓		Owner will choose carpet walnut wainscot
Break Rm.		✓					✓			✓		✓				✓	✓		Use water-resistant finish
Womens Rm.	✓				✓								✓	✓			✓		
Mens Rm.	✓				✓								✓	✓			✓		
Furnace Rm.				✓			✓						✓						
Warehouse				✓			✓					✓							Use water-resistant finishes

INFORMATION SHEET

BLC · 239-B

INFORMATION SHEET

VI. Characteristics of construction drawings (Assignment Sheets #6 - #10)

A. Plot plan

1. Location of structure on site
2. Finished and existing grade contours
3. Property lines
4. Location of utilities
5. Location of existing conditions

   (NOTE: This includes trees, buildings, and other structures.)

B. Foundation plan

1. Location of footings, grade beams, foundation walls, stem walls, piers, equipment footings, and foundations
2. Size of footings, grade beams, foundation walls, stem walls, piers, equipment footings, and foundations
3. Location and size of anchor bolts and reinforcing steel

C. Floor plan

1. Outside walls, including the location and dimensions of all exterior openings
2. Types of construction through use of symbols
3. Location of interior walls and partitions
4. Location and swing of doors
5. Stairways
6. Location of equipment
7. Types of floor finishes

D. Elevations

1. Grade lines
2. Floor heights

INFORMATION SHEET

3. Window and door types
4. Roof lines
5. Other exterior dimensions
6. Material types

E. Sections

1. Cutaway drawings such as stairs, walls, chimneys
2. Wall thickness at various locations
3. Anchors and bonds

(NOTE: In a sectional view, the cut is usually made vertically and is limited to the specific portion of the building the architect wishes to clarify.)

F. Details

(NOTE: These drawings are primarily used to show details of construction that are too small or not shown in sufficient detail on the plan or elevation drawings. They may be full size or to a larger scale than the plan, elevation, or sectional view.)

1. Windows
2. Doors (interior and exterior)
3. Door frames
4. Built-ins
5. Millwork, trim, and specialty items
6. Stairs and railings
7. Wall partitions
8. Ornamental ironwork

(NOTE: Sections are used freely on detail drawings.)

G. Schedules

1. Window
2. Door

INFORMATION SHEET

3. Room finishes
4. Paint
5. Appliances
6. Fixtures

VII. Divisions found in building plans

A. Architectural

1. Site plan
2. Floor plans
3. Elevations

B. Structural

1. Framing
2. Steelwork
3. Roof construction
4. Floor construction

C. Mechanical and electrical

1. Heating
2. Air conditioning
3. Water and sewage
4. Electricity

(NOTE: If the building is small and not too elaborate, the architect may combine the sections so that the floor plan will include framing, mechanical, and electrical information.)

VIII. Alphabet of lines (Transparency #1)

A. Object line

B. Dimension line

C. Extension line

INFORMATION SHEET

   D. Hidden line

   E. Center line

   F. Section line (cutting plane)

   G. Break line, long

   H. Break line, short

   I. Phantom line

   J. Leader

   K. Fixture line

   L. Section lining

IX. Descriptions of types of lines (Transparency #2)

   A. Object lines — Heavy lines that show main outline of the structure, including exterior walls, interior partitions, porches, patios, sidewalks, parking lots, and driveways

   (NOTE: These lines shall be the outstanding lines on the drawings.)

   B. Dimension lines — Thin, unbroken lines that designate structure dimensions

   C. Extension lines — Lines that extend, but do not touch, the object lines; permit dimension lines to be drawn between them

   D. Hidden lines — Short dashes used to show lines that are not visible from that view

   E. Center lines — Series of long and short dashes used to designate centers and provide a reference point for dimensioning

   (NOTE: Sometimes it is necessary to offset center lines.)

   F. Section lines (cutting plane) — Heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning; shows the direction from which the section is supposed to be viewed

   G. Break lines, long — Ruled lines with freehand breaks; used when an area cannot or should not be drawn entirely

INFORMATION SHEET

H. Break lines, short — Wavy, uneven freehand lines; used when an area cannot or should not be drawn entirely

I. Phantom lines — Thin lines consisting of a series of one long and two short dashes; used to indicate alternate positions of moving parts, adjacent positions of related parts, and for repeated details

J. Leaders — Broad lines drawn lightly with an arrow on the end; used to connect a note or dimension to a part of the structure

(NOTE: These lines are sometimes curved to eliminate confusion with other lines.)

K. Fixture lines — Thin lines used to outline the shape of equipment and furnishings

(NOTE: These lines are light to eliminate confusion with object lines.)

L. Section lining — Lightly drawn lines used to draw the section lining in sectional drawings; different material symbol is used for each building material

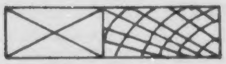
X. Architectural floor plan and sectioning symbols

(NOTE: Check architect's drawings for symbols for particular jobs.)

A. Floor plans (Figures 1-29)

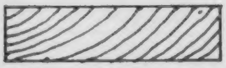
1. Wood (rough)

FIGURE 1



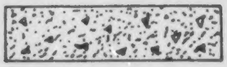
2. Wood (finish)

FIGURE 2



3. Concrete

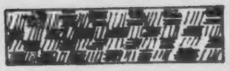
FIGURE 3



INFORMATION SHEET

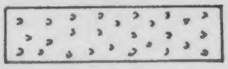
4. Earth

FIGURE 4



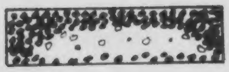
5. Cinders

FIGURE 5



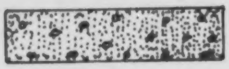
6. Gravel

FIGURE 6



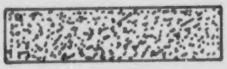
7. Gravel (with sand)

FIGURE 7



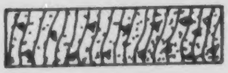
8. Sand, plaster, cement

FIGURE 8



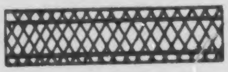
9. Concrete block

FIGURE 9



10. Structural clay tile (glazed)

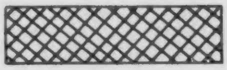
FIGURE 10



INFORMATION SHEET

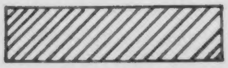
11. Structural clay tile (unglazed)

FIGURE 11



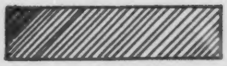
12. Common brick

FIGURE 12



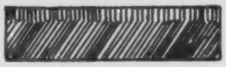
13. Face brick

FIGURE 13



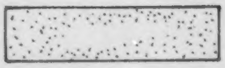
14. Firebrick

FIGURE 14



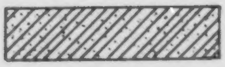
15. Cut stone

FIGURE 15



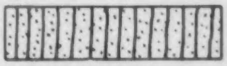
16. Rubble

FIGURE 16



17. Cast stone

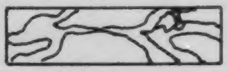
FIGURE 17



INFORMATION SHEET

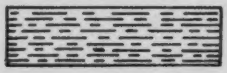
18. Marble

FIGURE 18



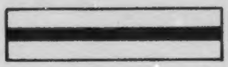
19. Slate, bluestone, soapstone

FIGURE 19



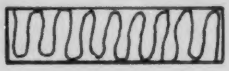
20. Waterproofing

FIGURE 20



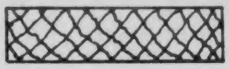
21. Insulation (loose fill or batts)

FIGURE 21



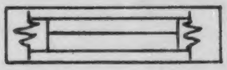
22. Insulation (boards or quilts)

FIGURE 22



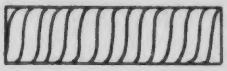
23. Plate or sheet glass

FIGURE 23



24. Structural glass

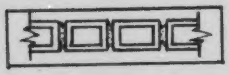
FIGURE 24



INFORMATION SHEET

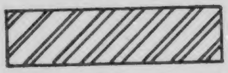
25. Glass block

FIGURE 25



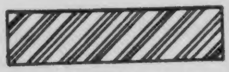
26. Steel or iron

FIGURE 26



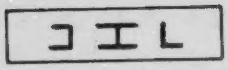
27. Aluminum

FIGURE 27



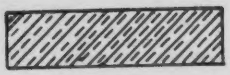
28. Structural steel

FIGURE 28



29. Brass or bronze

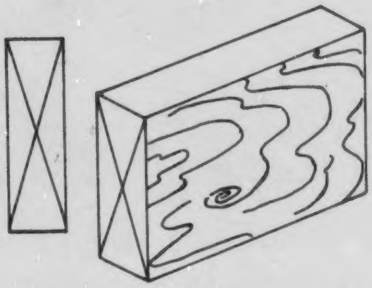
FIGURE 29



B. Sectioning (Figures 30-33)

1. Rough lumber

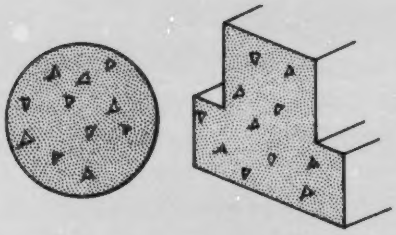
FIGURE 30



INFORMATION SHEET

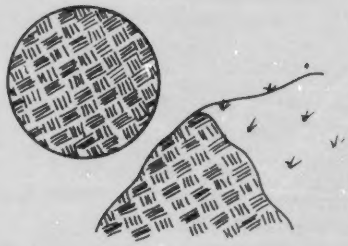
2. Concrete

FIGURE 31



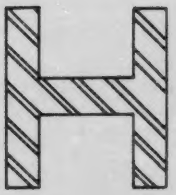
3. Earth

FIGURE 32



4. Metal

FIGURE 33

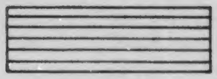


XI. Architectural symbols for elevations, exterior walls, and floor finishes

A. Elevations (Figures 34-40)

1. Brick

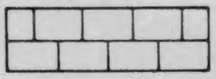
FIGURE 34



INFORMATION SHEET

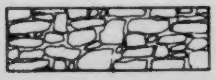
2. Ashlar

FIGURE 35



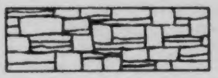
3. Rubble

FIGURE 36



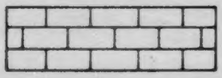
4. Squared stone

FIGURE 37



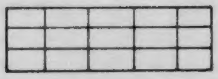
5. Running bond masonry

FIGURE 38



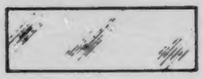
6. Stack bond masonry

FIGURE 39



7. Glass

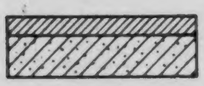
FIGURE 40



B. Exterior walls (Figures 41-47)

1. Face brick over rubble

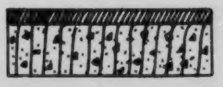
FIGURE 41



INFORMATION SHEET

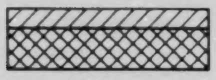
2. Face brick over concrete block

FIGURE 42



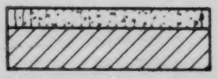
3. Brick over structural clay tile

FIGURE 43



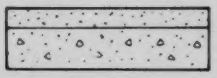
4. Cast stone over brick

FIGURE 44



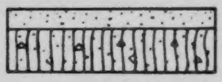
5. Cut stone over concrete

FIGURE 45



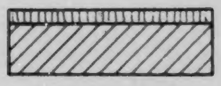
6. Cut stone over concrete block

FIGURE 46



7. Architectural terra-cotta over brick

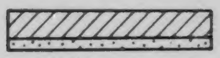
FIGURE 47



C. Floor finishes (Figures 48-51)

1. Brick on concrete

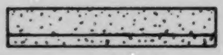
FIGURE 48



INFORMATION SHEET

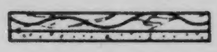
2. Stone on concrete

FIGURE 49



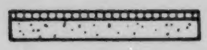
3. Marble on concrete

FIGURE 50



4. Tile on concrete

FIGURE 51



XII. Abbreviations commonly used on plans

A. Architectural — ARCH

B. Architectural terra-cotta — ATC

C. Anchor bolt — AB

D. Angle — ∠

E. Bench mark — BM or ⊕

F. Brick — BRK

G. Bearing — BRG

H. Block — BLK

I. Bronze — BRZ

J. Brick course — BRK C

K. Building line — BL

L. Center — CTR

M. Center line — CL or ℄

N. Center to center — C to C

O. Caulking — CLKG

P. Concrete block — CONC B

Q. Cast concrete — C CONC

R. Ceramic — CER

S. Cast stone — CS

T. Catch basin — CB

U. Cinder block — CIN BL

V. Column — COL

W. Channel — [

X. Concrete — CONC

Y. Course — C

Z. Cubic foot — CU FT

INFORMATION SHEET

AA. Cubic inch — CU IN
BB. Cubic yard — CU YD
CC. Dampproofing — DP
DD. Detail — DET
EE. Elevation — ELEV
FF. Expansion joint — EXP JT
GG. Facing tile — FT
HH. Firebrick — FBRK
II. Finish grade — FG
JJ. Fireplace — FP
KK. Flashing — FL
LL. Fireproof — FPRF
MM. Foundation — FDN
NN. Grade — GR
OO. Grade line — GL
PP. Glass block — GLBL
QQ. Head — HD
RR. Insulate — INS
SS. Joist — JST
TT. Joint — JT
UU. Linear — LIN
VV. Live load — LL
WW. Limestone — LS
XX. Masonry opening — MO
YY. Modular — MOD
ZZ. Marble — MR
AAA. Manhole — MH
BBB. Material — MATL
CCC. Nominal — NOM
DDD. Not to scale — NTS
EEE. On center — OC
FFF. Opening — OPNG
GGG. Overall — OA
HHH. Partition — PTN
III. Parallel — PAR
JJJ. Precast — PRCST
KKK. Reinforce — REINF
LLL. Rough opening — RO
MMM. Scale — SC
NNN. Specification — SPEC
OOO. Standard — STD
PPP. Structural — STR
QQQ. Stone — ST
RRR. Terra-cotta — TC
SSS. Typical — TYP
TTT. Waterproofing — WP
UUU. Weep hole — WH

INFORMATION SHEET

XIII. Rules for reading an architect's scale

- A. Do not use a scale if dimensions are available
- B. Be sure that scale is lying flat on surface being measured
- C. Select proper scale ratio
- D. Measure from center of one line to center of next line
- E. Read in order feet, inches, and fractions of inches
- F. Double-check all measurements

XIV. Common scales to which plans are drawn

- A. 1/8" = 1' - 0"
- B. 1/4" = 1' - 0"
- C. 1/2" = 1' - 0"
- D. 1 1/2" = 1' - 0"
- E. 3" = 1' - 0"

INFORMATION SHEET

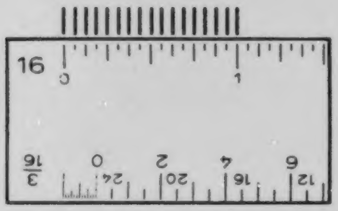
XV. Reading an architect's scale (Figures 52-70; Transparencies #3 and #4; Assignment Sheets #1 - #5)

A. 12" represents 1'-0"

1. Sixteenths

EXAMPLE:

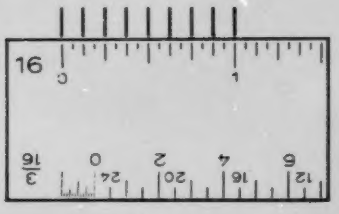
FIGURE 52


16
0
1
3/16
0
2
4
6
24
20
16
12

2. Eighths

EXAMPLE:

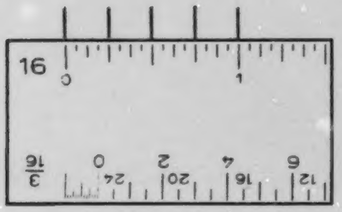
FIGURE 53


16
0
1
3/16
0
2
4
6
24
20
16
12

3. Fourths

EXAMPLE:

FIGURE 54


16
0
1
3/16
0
2
4
6
24
20
16
12

INFORMATION SHEET

4. Halves

EXAMPLE:

FIGURE 55

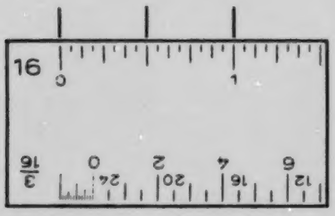
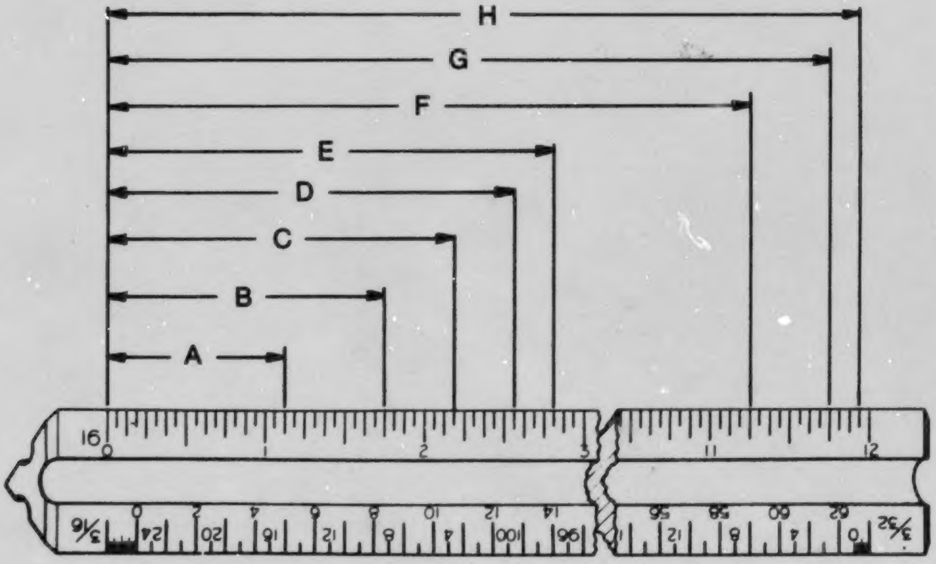

16
0
1
3/16
0
2
4
6
24
20
16
12

FIGURE 56


H
G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
3/32

A = 1" + 2/16" = 1 2/16" or 1 1/8"

B = 1" + 12/16" = 1 12/16" or 1 3/4"

C = 2" + 3/16" = 2 3/16"

D = 2" + 9/16" = 2 9/16"

E = 2" + 13/16" = 2 13/16"

F = 11" + 4/16" = 11 4/16" or 11 1/4"

G = 11" + 12/16" = 11 12/16" or 11 3/4"

H = 11" + 15/16" = 11 15/16"

INFORMATION SHEET

B. 6" represents 12" or 1'-0"

EXAMPLE:

FIGURE 57

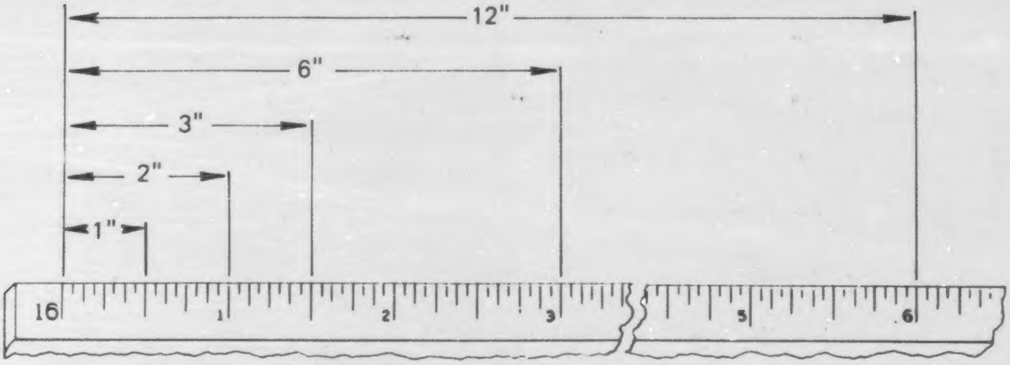
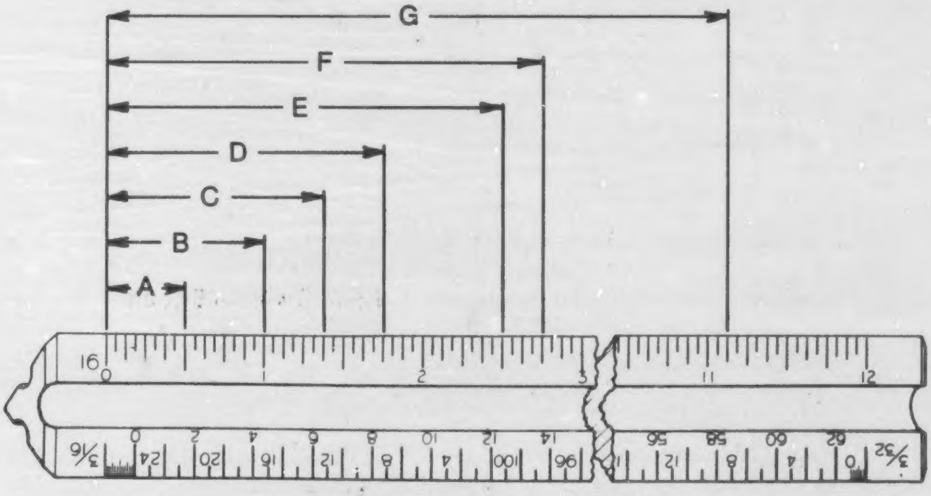

12"
6"
3"
2"
1"
16
1
2
3
5
6

FIGURE 58


G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
3/32

A = 8/8 = 1"

B = 16/8 = 2"

C = 2" + 6/8" = 2 6/8" or 2 3/4"

D = 3" + 4/8" = 3 4/8" or 3 1/2"

E = 5"

F = 5" + 4/8" = 5 4/8" or 5 1/2"

G = 22" + 2/8" = 22 2/8" or 22 1/4"

INFORMATION SHEET

C. 3" represents 12" or 1'-0"

EXAMPLES:

FIGURE 59

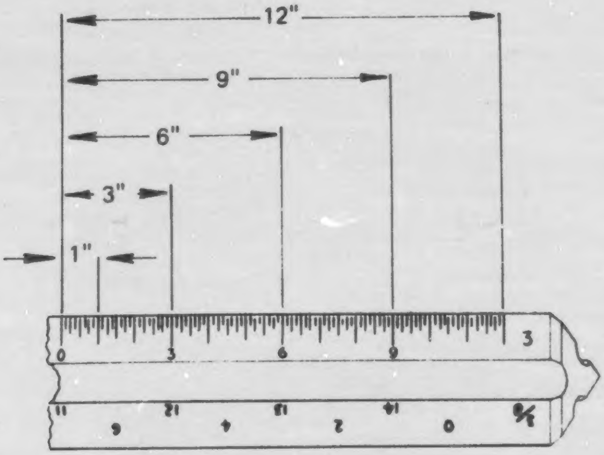
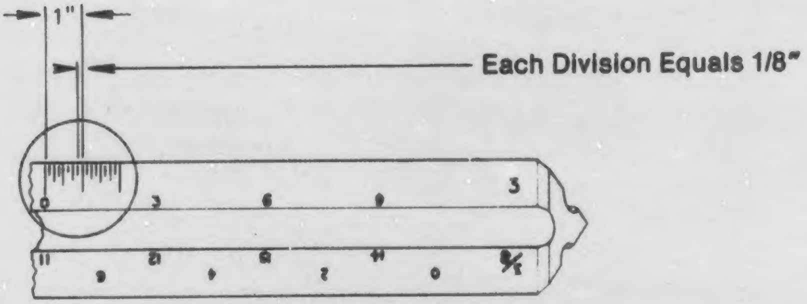
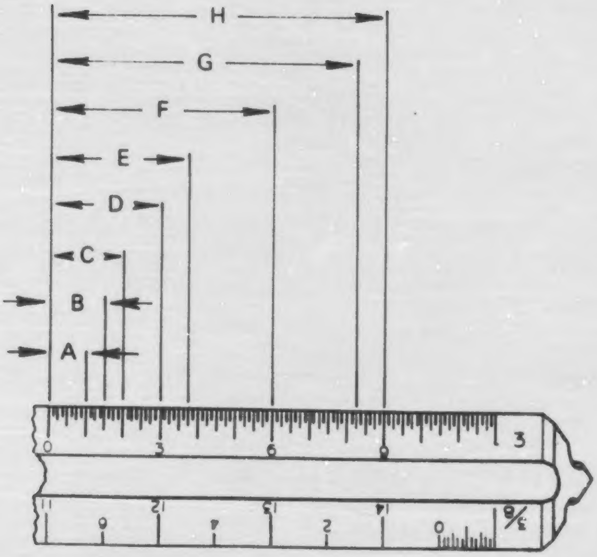

12"
9"
6"
3"
1"
0
3
6
9
3
11
12
13
14

FIGURE 60


1"
Each Division Equals 1/8"
0
3
6
9
3

INFORMATION SHEET

FIGURE 61


H
G
F
E
D
C
B
A
0
3
6
9
3
11
12
13
14
6
4
2
0
3/8

A = 8 graduations = 1"

B = 1" + 4/8" = 1 4/8" or 1 1/2"

C = 1" + 8/8" = 16/8" = 2"

D = 3"

E = 3" + 6/8" = 3 6/8" or 3 3/4"

F = 6"

G = 8" + 2/8" = 8 2/8" or 8 1/4"

H = 9"

INFORMATION SHEET

D. 1 1/2" represents 12" or 1'-0"

EXAMPLES:

FIGURE 62

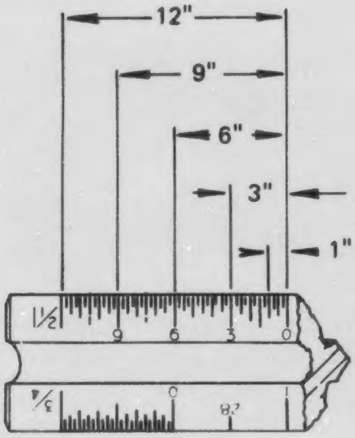
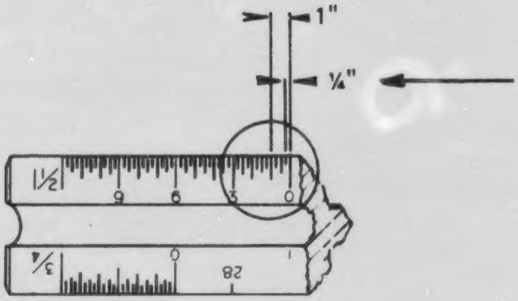

12"
9"
6"
3"
1"
1½
9
6
3
0
0
28
1

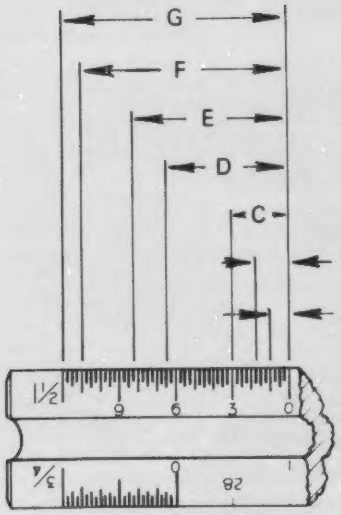
FIGURE 63


1"
¼"
1½
9
6
3
0
0
28
1

Each Division Equals 1/4"

INFORMATION SHEET

FIGURE 64


G
F
E
D
C
B
A
1½
9
6
3
0
¾
0
28
1

A = 4 graduations = 1"

B = 1" + ¾" = 1 ¾"

C = 3"

D = 6" + 2/4" = 6 2/4" or 6 ½"

E = 8" + ¼" = 8 ¼"

F = 11"

G = 12" = 1' - 0"

INFORMATION SHEET

E. ½″ represents 12″ or 1′-0″

FIGURE 65

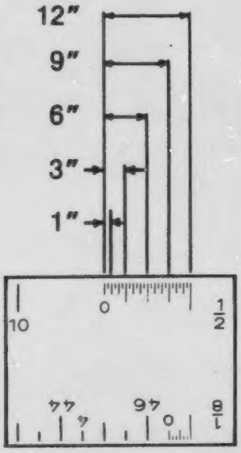
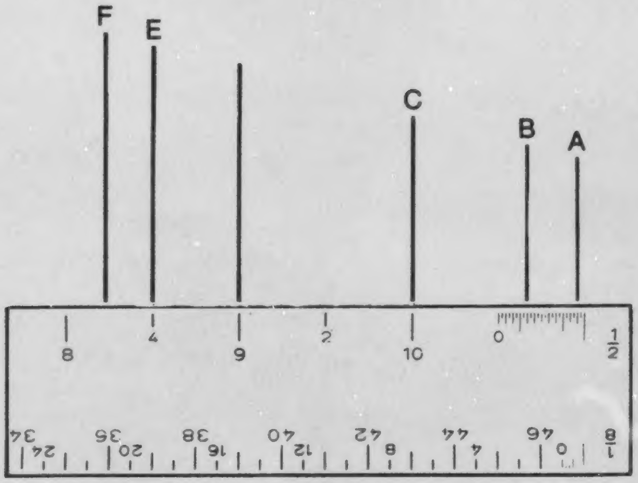

12″
9″
6″
3″
1″
10
0
1/2
44
46
0
8
1

FIGURE 66


F
E
C
B
A
8
4
6
2
10
0
1/2
34
24
36
20
38
16
40
12
42
8
44
4
46
0
8
1

A = 11″

B = 4″

C = 1′-0″

D = 3′-0″

E = 4′-0″

F = 4′-6″

INFORMATION SHEET

F. ¼" represents 12" or 1'-0"

FIGURE 67

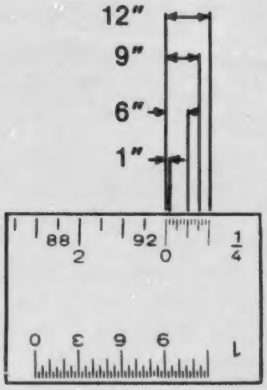
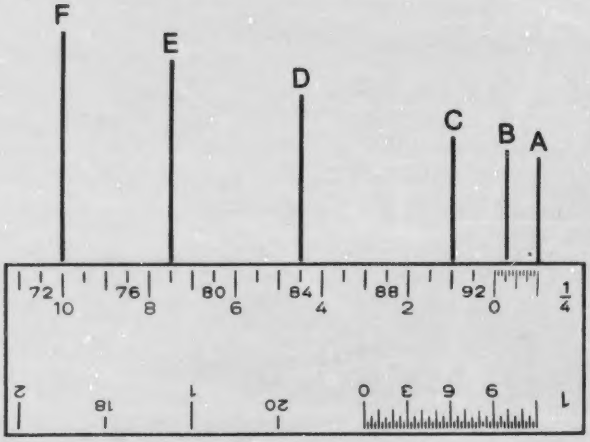

12"
9"
6"
1"
88
92
2
0
1/4
0
3
6
9
1

FIGURE 68


F
E
D
C
B
A
72
76
80
84
88
92
10
8
6
4
2
0
1/4
2
18
1
20
0
3
6
9
1

A = 12" or 1'-0"

B = 3"

C = 1"-0"

D = 4'-6"

E = 7'-6"

F = 10'-0"

INFORMATION SHEET

G. 1/8" represents 12" or 1'-0"

FIGURE 69

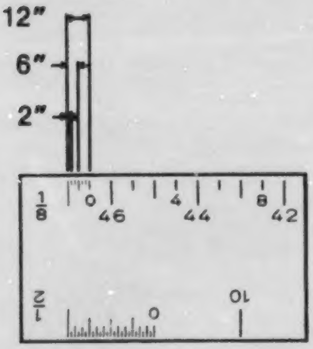
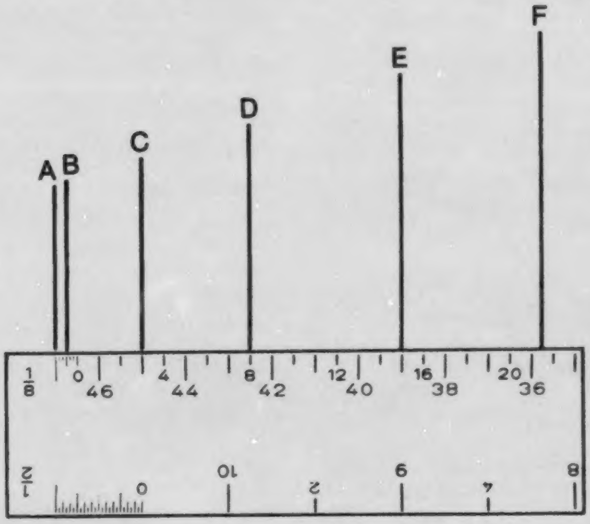

12"
6"
2"
1/8
0
4
8
46
44
42
1/2
0
10

FIGURE 70


A
B
C
D
E
F
1/8
0
4
8
12
16
20
46
44
42
40
38
36
1/2
0
10
2
6
4
8

A = 12" or 1'-0"

B = 6"

C = 3' "-0"

D = 8'-0"

E = 15'-0"

F = 21'-6"

INFORMATION SHEET

XVI. Items found on structural drawings

- A. Heights of finished floors and walls
- B. Height and bearing of bar joist or steel joist
- C. Locations of bearing steel
- D. Height of steel beams, concrete planks, concrete Ts, and poured-in-place concrete
- E. Bearing plate locations
- F. Reinforcing steel and schedules showing size and spacing
- G. Anchor bolt locations, size of bolts, and spacing
- H. Solid masonry units or block filled solid with mortar and reinforced with steel
- I. Stairs
- J. Schedules

XVII. Major items that may be covered in a set of masonry specifications

- A. General
  1. Description
  2. Codes and standards
  3. Submittals
  4. Product handling and storage
  5. Quality assurance
  6. References
  7. Prism testing
  8. Unit strength method testing
  9. Sample panels
  10. Mortar test

INFORMATION SHEET

B. Products

1. General
2. Mortar
3. Structural grout
4. Brick
5. Concrete masonry units
6. Precast concrete lintels
7. Setting material for base and bearing plates
8. Reinforcement and anchorages
9. Through wall flashing
10. Insulation materials
11. Specialty masonry accessories
12. Mortar-coloring agent
13. Control joint resilient keys
14. Expansion joint materials
15. Rope wick

C. Execution

1. Surface conditions
2. Coordination
3. Placing tolerances
4. Mixing mortar
5. Installation — general
6. Time requirements for placing load-bearing masonry
7. Laying concrete masonry units

INFORMATION SHEET

8. Laying brick units
9. Placing reinforcement and metal ties in concrete masonry
10. Placing reinforcement and metal ties in brick masonry
11. Installing control joints
12. Installing expansion joints
13. Filling bond beams and lintels
14. Filling piers, pilasters, and grouted wall construction cavities
15. Setting base and bearing plates
16. Pilasters
17. Flashing installation
18. Installation of insulation
19. Backplastering
20. Parging
21. Installing items furnished by other trades
22. Built-in items furnished and installed by other trades
23. Construction of weep holes
24. Protection during construction
25. Cold weather construction
26. Pointing and caulking
27. Cleaning

XVIII. Items that may be shown in detail on drawings

A. Footings, foundations, sills, and walls

B. Anchor bolts

C. Beams, floor joist, and bridging

D. Sills, floor framing, exterior walls, and vapor barriers

INFORMATION SHEET

E. Weep holes

F. Floor height, thickness, expansion, and reinforcing

G. Interior walls and partitions

H. Metal ties, anchors, and backup

I. Windows and doors

J. Beam and joist bearing

K. Roof, cornice, soffit, and ceilings

L. Gravel stops, fascia, and flashing

M. Fireplaces

N. Stairwells and stair assembly

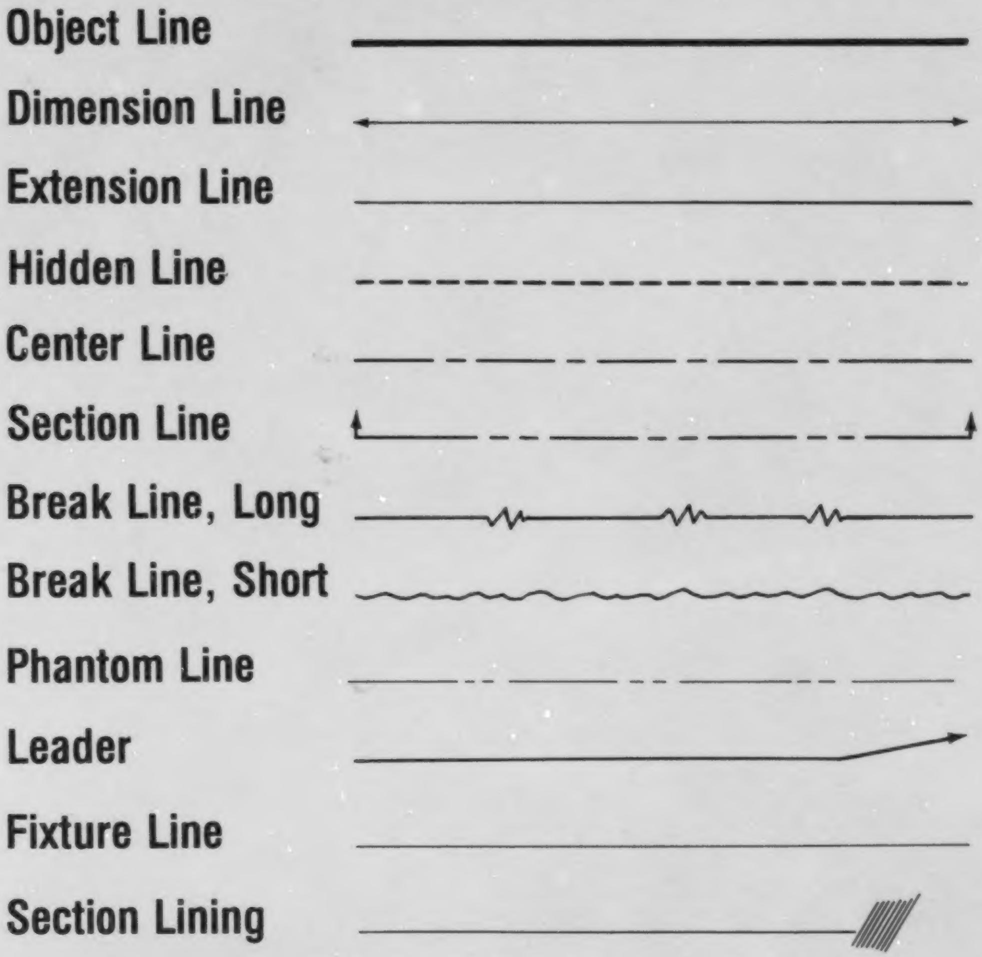
O. Insulation

P. Flashing and waterproofing

Q. Caulking and weatherproofing

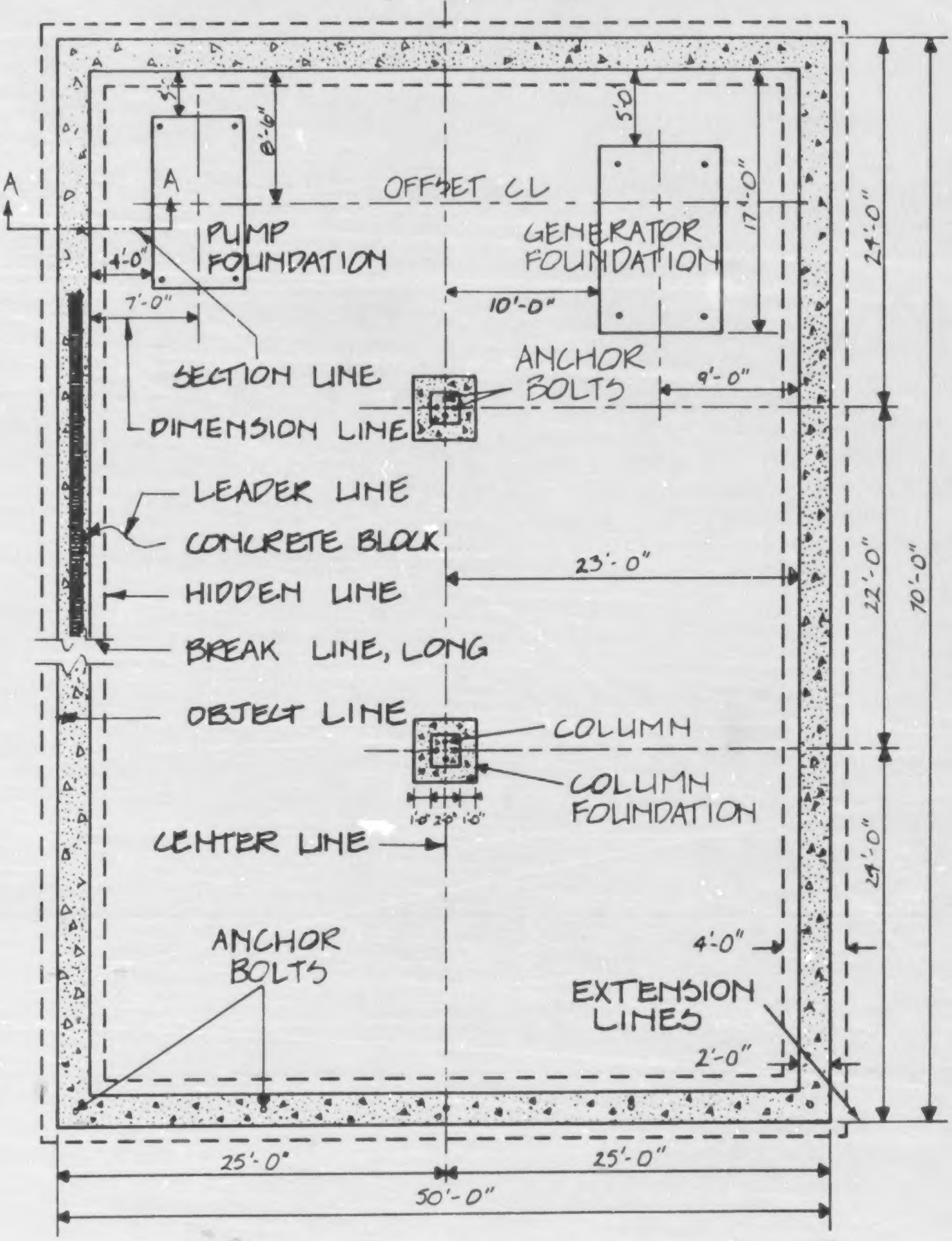
R. Control joint location

Alphabet of Lines


Object Line
Dimension Line
Extension Line
Hidden Line
Center Line
Section Line
Break Line, Long
Break Line, Short
Phantom Line
Leader
Fixture Line
Section Lining

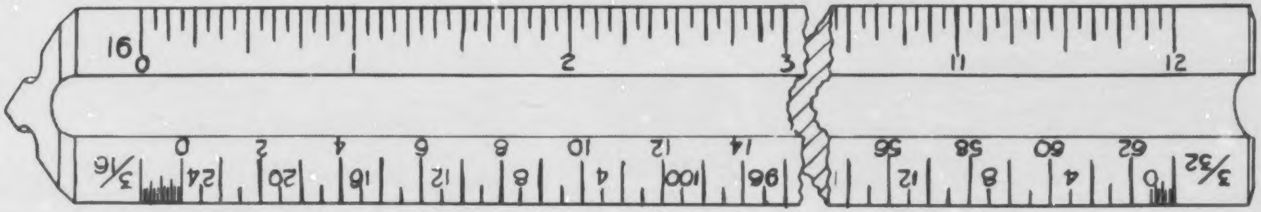
Alphabet of Lines

(Continued)

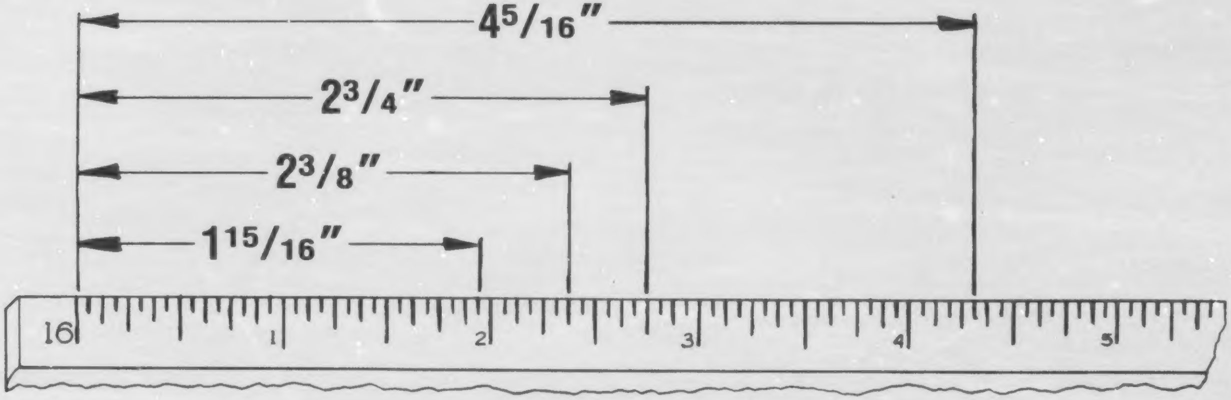

A
A
OFFSET CL
PUMP FOUNDATION
GENERATOR FOUNDATION
5'-0"
8'-6"
5'-0"
17'-0"
4'-0"
7'-0"
10'-0"
SECTION LINE
DIMENSION LINE
ANCHOR BOLTS
9'-0"
LEADER LINE
CONCRETE BLOCK
HIDDEN LINE
23'-0"
BREAK LINE, LONG
OBJECT LINE
COLUMN
COLUMN FOUNDATION
1'-0" 2'-0" 1'-0"
CENTER LINE
ANCHOR BOLTS
4'-0"
EXTENSION LINES
2'-0"
24'-0"
22'-0"
24'-0"
70'-0"
25'-0"
25'-0"
50'-0"

SCALE = 3/32" = 1'-0"

Architect's Scale

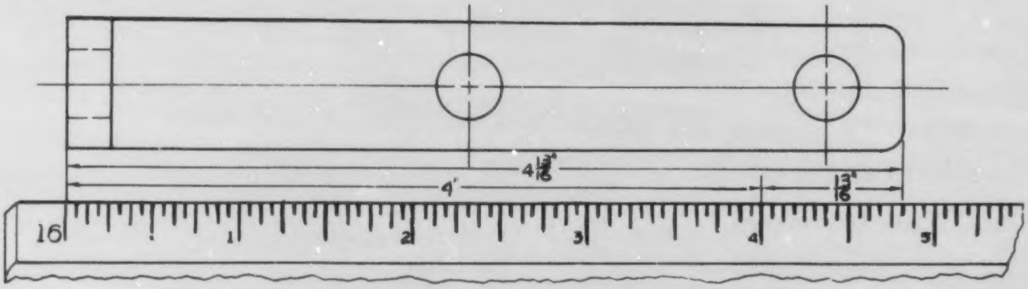

16
0
1
2
3
11
12
3/16
0
2
4
6
8
10
12
14
24
20
18
16
12
8
4
100
96
56
58
60
62
12
8
4
0
3/32

This is how the architect's scale should look.

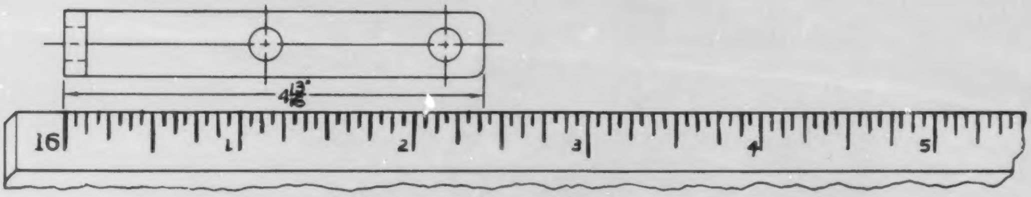

4 5/16"
2 3/4"
2 3/8"
1 15/16"
16
1
2
3
4
5

Measurements at Scale of 12" = 1'-0"

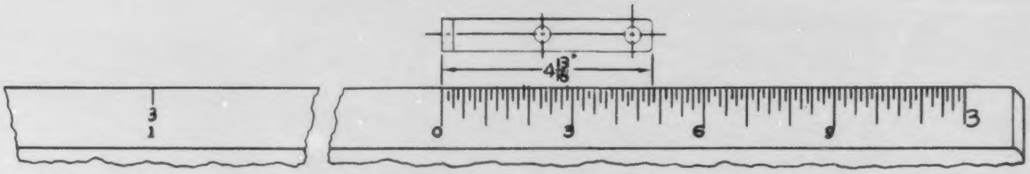
Comparison of Scales


4 13/16"
4"
13/16"
16
1
2
3
4
5

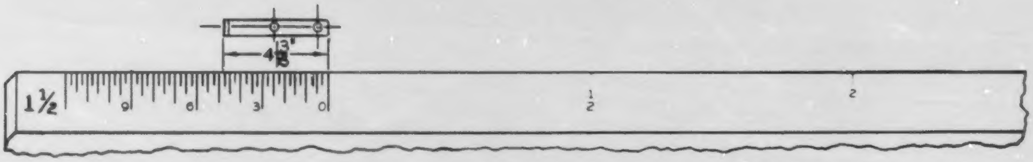
Full Scale (12" = 1'-0")


4 13/16"
16
1
2
3
4
5

One-Half Scale (6" = 1'-0")


4 13/16"
3
1
0
3
6
9
3

One-Fourth Scale (3" = 1'-0")


4 13/16"
1½
9
6
3
0
1/2
2

One-Eighth Scale (1½" = 1'-0")

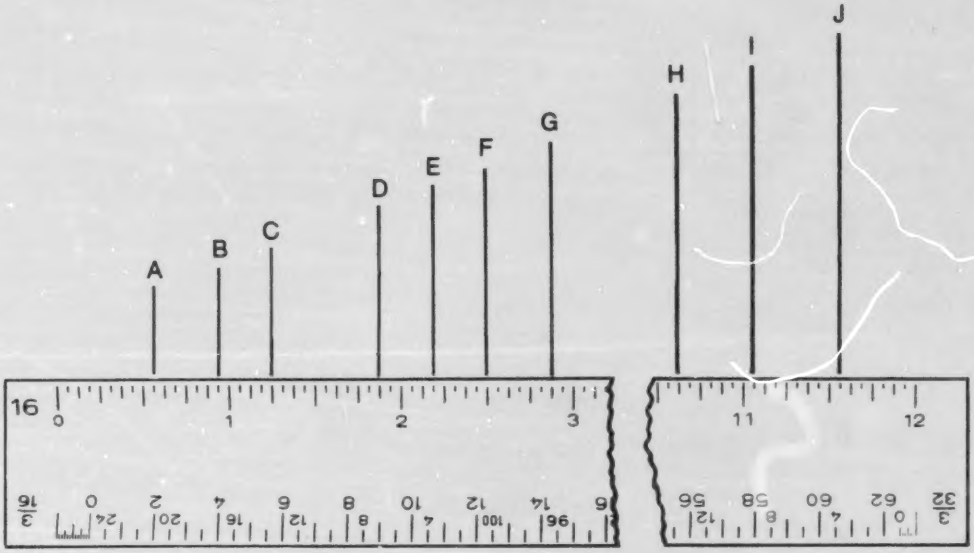
BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #1 — READ THE ARCHITECT'S SCALE USING SCALE 12" = 1' - 0"

NAME ______________________________ SCORE ____________

Reading the architect's scale is a necessary skill for bricklayers. This assignment sheet is a practice for reading the architect's scale using the scale 12" = 1' - 0".

Read the scale below by reading the distance from 0 to the lettered points indicated. Write the correct measurements in the blanks.


A
B
C
D
E
F
G
H
I
J
16
0
1
2
3
11
12
3/16
0
2
4
6
8
10
12
14
56
58
60
62
3/32

A. 0 to A = __________

B. 0 to B = __________

C. 0 to C = __________

D. 0 to D = __________

E. 0 to E = __________

F. 0 to F = __________

G. 0 to G = __________

H. 0 to H = __________

I. 0 to I = __________

J. 0 to J = __________

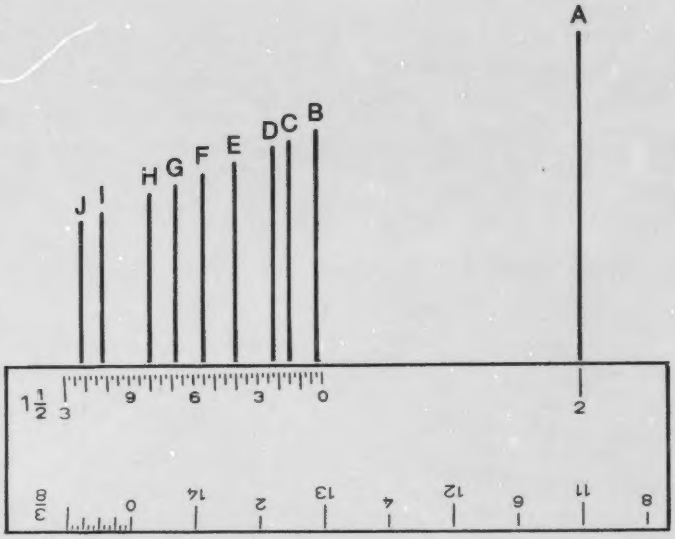
BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #2 — READ THE ARCHITECT'S SCALE USING SCALE 1 ½" = 1' - 0"

NAME ______________________________ SCORE ______________

Reading the architect's scale is a necessary skill for bricklayers. This assignment sheet is a practice for reading the architect's scale using the scale 1 ½" = 1' - 0".

Read the scale below by reading the distance from 0 to the lettered points indicated. Write the correct measurements in the blanks.



A. 0 to A = __________

B. 0 to B = __________

C. 0 to C = __________

D. 0 to D = __________

E. 0 to E = __________

F. 0 to F = __________

G. 0 to G = __________

H. 0 to H = __________

I. 0 to I = __________

J. 0 to J = __________

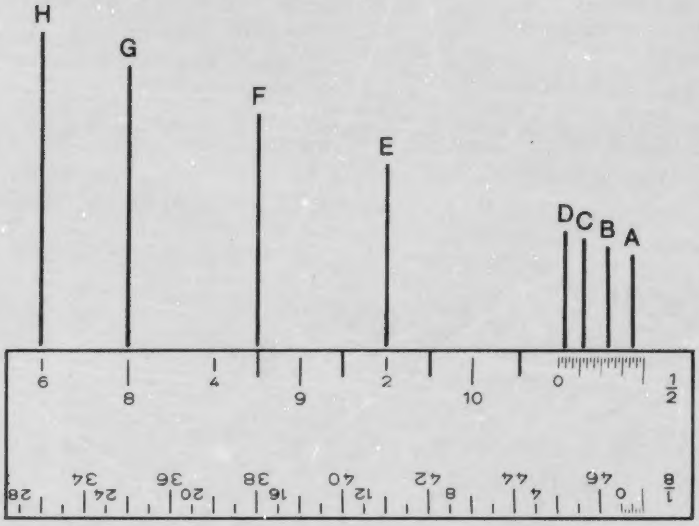
BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #3 — READ THE ARCHITECT'S SCALE USING SCALE 1/2" = 1' - 0"

NAME ______________________________ SCORE ______________

Reading the architect's scale is a necessary skill for bricklayers. This assignment sheet is a practice for reading the architect's scale using the scale 1/2" = 1' - 0".

Read the scale below by reading the distance from 0 to the lettered points indicated. Write the correct measurements in the blanks.


H
G
F
E
D
C
B
A
6
8
4
9
2
10
0
1/2
34
36
38
40
42
44
46
28
24
20
16
12
8
4
0
1/8

A. 0 to A = __________

B. 0 to B = __________

C. 0 to C = __________

D. 0 to D = __________

E. 0 to E = __________

F. 0 to F = __________

G. 0 to G = __________

H. 0 to H = __________

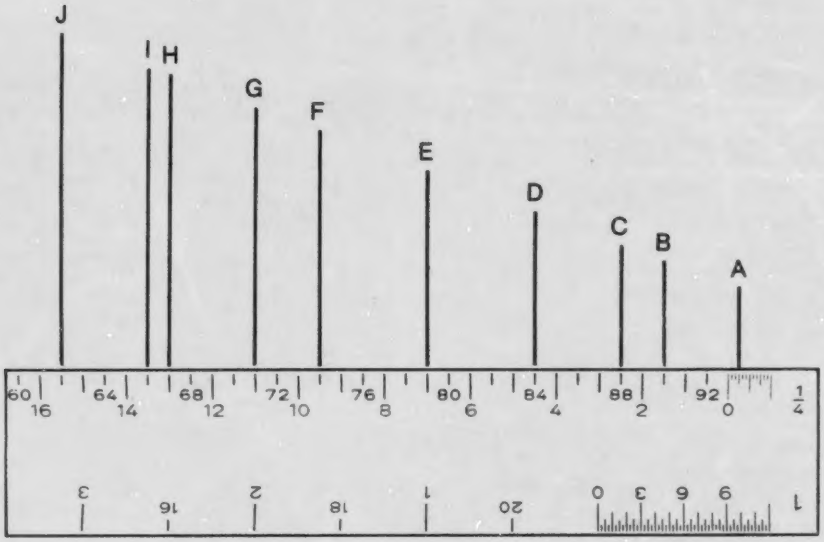
BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #4 — READ THE ARCHITECT'S SCALE USING SCALE 1/4" = 1' - 0"

NAME ______________________________ SCORE ______________

Reading the architect's scale is a necessary skill for bricklayers. This assignment sheet is a practice for reading the architect's scale using the scale 1/4" = 1' - 0".

Read the scale below by reading the distance from 0 to the lettered points. Write the correct measurements in the blanks.


J
I
H
G
F
E
D
C
B
A
60
64
68
72
76
80
84
88
92
16
14
12
10
8
6
4
2
0
1/4
3
16
2
18
1
20
0
3
6
9
1

A. 0 to A = __________

B. 0 to B = __________

C. 0 to C = __________

D. 0 to D = __________

E. 0 to E = __________

F. 0 to F = __________

G. 0 to G = __________

H. 0 to H = __________

I. 0 to I = __________

J. 0 to J = __________

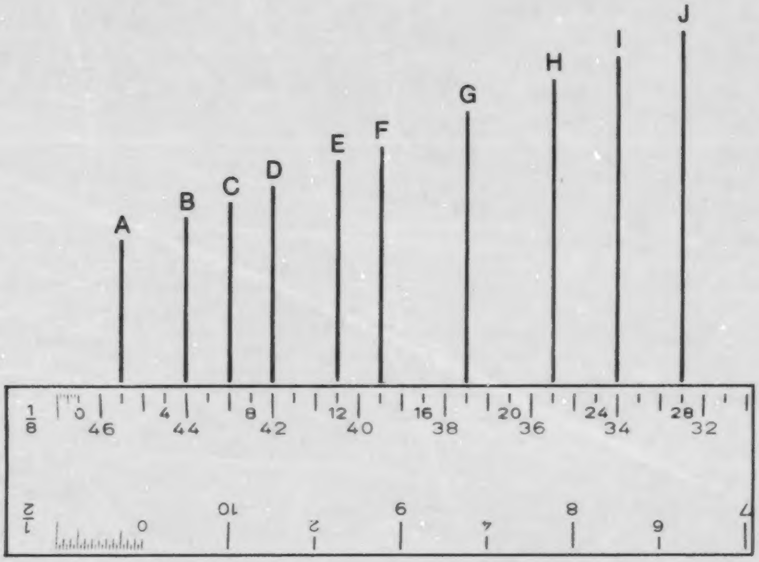
BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #5 — READ THE ARCHITECT'S SCALE USING SCALE 1/8" = 1' - 0"

NAME ________________________________ SCORE ____________

Reading the architect's scale is a necessary skill for bricklayers. This assignment sheet is a practice for reading the architect's scale using the scale 1/8" = 1' - 0".

Read the scale below by reading the distance from 0 to the lettered points indicated. Write the correct measurements in the blanks.


A
B
C
D
E
F
G
H
I
J
1/8
0
4
8
12
16
20
24
28
46
44
42
40
38
36
34
32
1/2
0
10
2
6
4
8
6
4

A. 0 to A = __________

B. 0 to B = __________

C. 0 to C = __________

D. 0 to D = __________

E. 0 to E = __________

F. 0 to F = __________

G. 0 to G = __________

H. 0 to H = __________

I. 0 to I = __________

J. 0 to J = __________

BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #6 — READ ARCHITECTURAL PLANS

NAME ______________________________ SCORE ______________

A bricklayer must understand the architectural plans in order to complete a project successfully. Answering the questions will help you become familiar with plans.

Referring to the drawings (Sheets #1-#12) in Information Sheet, Section V, answer the following questions.

PART I — Plot Plan (Sheet #1)

A. What are the outside dimensions of the building?

____

B. Where is the bench mark located?

____

C. What is the elevation of the finish floor?

____

D. What is the difference between bench mark elevation and finish floor elevation?

____

E. What scale was used on this drawing?

____

PART II — Floor Plan (Sheet #3)

A. How many different types and sizes of doors are used in the building?

____

B. What strength concrete is to be used on floors?

____

C. What size block is used on the pipe chase?

____

ASSIGNMENT SHEET #6

D. What are the inside dimensions of the furnace room?

____

E. How many of the outside walls will be brick?

____

PART III — Elevations (Sheets #4 and #5)

A. What is the height of the roof at the rear of the building?

____

B. What size and type of gutter is used on the building?

____

C. What type of finish wall is on the east elevation?

____

D. What is the height of the building from finish floor?

____

E. What type of coping is used on the building?

____

PART IV — Sections (Sheets #6 - #8)

A. What size bar joists are used on the building?

____

B. What is the size of reinforcing anchor rods used?

____

C. What type of brick is used on the building?

____

D. What type of perimeter insulation is used on the building?

____

ASSIGNMENT SHEET #6

E. What is the size and type of lintel used over glass block window?

____

PART V — Details (Sheet #9)

A. What types of materials are used on the planter?

____

B. How far apart are the weep holes spaced?

____

C. What size reinforcing steel is used in the trash bin slab?

____

D. What is the size of the footing on the trash bin?

____

E. What are the inside dimensions of the trash bin?

____

BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #7 — READ A STRUCTURAL PLAN

NAME ______________________________ SCORE ______________

Bricklayers must be able to interpret structural plans correctly. This assignment sheet is a practice in reading a structural plan.

Referring to Sheets #5, #7, and #8 in Information Sheet, Section V, answer the following questions.

A. How many 12H4 bar joists are used in the building?

____

B. How far apart are the bar joists to be set?

____

C. What is the distance from finish floor to the roof line on the north elevation?

____

D. What size reinforcement bars are used in the footings?

____

E. Where will flashing be installed?

____

F. What type of deck is used on the building?

____

G. What type of ceilings are used in the office and rest rooms?

____

H. What type of lintel is used over overhead door?

____

I. What type of roof is used on building?

____

J. What is ceiling height in the rest rooms?

____

BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #8 — READ A FLOOR PLAN

NAME ______________________________ SCORE ______________

Bricklayers must be able to interpret floor plans correctly. Completing this assignment sheet will give you practice in reading a floor plan.

Referring to Sheet #3 in Information Sheet, Section V, answer the following questions.

A. What is the outside length of the building?

____

B. What are the inside dimensions of the office?

____

C. What is the thickness of the south wall of the building?

____

D. What size door is used for the entrance?

____

E. What is the square footage of the women's room?

____

F. How much slope is on the slab for the wash area?

____

G. What type of floor is to be used in the rest rooms?

____

H. What type of window is used on the east wall?

____

I. What is the symbol for hose bibb?

____

J. What does the number (symbol) 2668 mean?

____

BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #9 — INTERPRET A SET OF MASONRY SPECIFICATIONS

NAME ______________________________ SCORE ____________

Bricklayers must be able to interpret a set of masonry specifications correctly. Completing this assignment sheet is a practice in working with masonry specifications.

Answer the following questions, using information from the sample set of specifications provided.

A. List four specified materials for which samples must be submitted before beginning work on a project.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

B. How many specimens are required for each class of masonry for a prism test?

____

C. What size mortar cubes must be fabricated for the advance test procedure?

____

D. 1. How many sample panels is the contractor obligated to construct?

____

2. What is a reasonable cost for an additional panel?

____

E. What is the compressive strength, water retention, and maximum air content for type M laboratory-prepared mortar?

1. Compressive strength — ______________________________
2. Water retention — ______________________________
3. Maximum air content — ______________________________

F. What type mortar or mortars shall be used for masonry?

1. In contact with the earth — ______________________________
2. Non-load-bearing — ______________________________
3. Firebrick — ______________________________

ASSIGNMENT SHEET #9

G. What are the minimum sizes of the following ties and anchors?

1. Rigid steel anchors — ______________________________
2. Dovetail anchors with anchor slots — ______________________________
3. Corrugated or crimped metal ties — ______________________________

H. List three types of through-wall flashing.

1. ______________________________
2. ______________________________
3. ______________________________

I. List three types of specialty masonry accessories.

1. ______________________________
2. ______________________________
3. ______________________________

J. List three items that mortar containing calcium chloride should not be placed adjacent to.

1. ______________________________
2. ______________________________
3. ______________________________

K. What is the minimum coverage for embedded reinforcement and ties?

____

L. What should bond beams and lintels spanning more than 3′ - 8″ be filled with?

______________________________ or ______________________________

M. What should be done between coats of backplaster to assure bonding?

____

N. What should partially completed walls or top of walls be covered with at the end of each day?

____

O. What precautions should be made when laying masonry at air temperature of 40°F to 25°F?

____

ASSIGNMENT SHEET #9

SAMPLE SET OF SPECIFICATIONS

MASONRY

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1.02 Codes and Standards
1.03 Submittals
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ASSIGNMENT SHEET #9

MASONRY

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3.21 Install Items Furnished by Other Trades
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3.23 Construction of Weep Holes
3.24 Protection During Construction
3.25 Cold Weather Construction
3.26 Pointing and Caulking
3.27 Cleaning

ASSIGNMENT SHEET #9

MASONRY

Section 04200 — Page 1

PART 1.00 — GENERAL

1.01 DESCRIPTION

A. Applicable requirements of conditions of contract and of sections listed under general requirements apply to work specified in this Section.

B. Work included:

Unit masonry required for this work is indicated on the Drawings and includes, but is not necessarily limited to:

1. Concrete and brick masonry work for (exterior walls, back-up, interior partitions), (face brick for cavity wall construction).
2. Furnish and install wall reinforcement and anchorages.
3. Install items furnished by other sections of the work (see 3.20).
4. Furnish and install masonry accessories (see 2.13 and 3.16).
5. Install reinforcement in bond beams and fill with concrete or grout (see 3.13).
6. Install reinforcement in bond beam lintels under 3' - 8" in length and fill with mortar.
7. Fill cells of block at pilasters and for grouted wall construction.
8. Fill brick pilasters with concrete.
9. (Grout under) (Mortar in) base and bearing plates on masonry walls.*
10. Slush mortar to fill all jambs of hollow metal frames.
11. Furnish and install insulation to be placed in masonry wall construction.
12. Parge walls where shown on Drawings.
13. Construct sample panels of masonry construction.

* A/E select proper phrase. In most cases mortar will be adequate.

ASSIGNMENT SHEET #9

C. Related work described elsewhere:*

1. Submittals: Section 01300
2. Cutting and Patching: Section 01040
3. Testing Laboratory: Section 01400
4. Earthwork: Section 02200
5. Concrete Reinforcement: Section 03200
6. Concrete: Section 03300
7. Metal Fabrications: Section 05500
8. Dampproofing: Section 07150
9. Water Repellent Coating: Section 07175
10. Insulation: Section 07200
11. Flashing and Sheet Metal: Section 07600
12. Sealants: Section 07900

* List only those that are necessary.

1.02 CODES AND STANDARDS:

A. Work of this Section shall comply with Chapter 53, Part III of the Wisconsin Administration Code and as supplemented in subsequent articles contained herein.

1.03 SUBMITTALS:

A. Test Reports

1. Concrete Masonry Units.
Submit to A/E, when requested, certificate from manufacturer that the concrete masonry units are 30 days old.
Submit in accordance with provisions of Section 01300.

ASSIGNMENT SHEET #9

2. Brick Units.
A test report for each type of brick to be used shall be submitted to A/E. Such test reports, not more than three years old, shall have been developed by an independent testing laboratory.* The test report shall provide data on:

   a. Compressive Strength.

   b. 24 Hour Cold Water Absorption.

   c. 5 Hour Boil Absorption.

   d. Saturation Coefficient.

   e. Initial Rate of Absorption.

All in accordance with ASTM C-67

* If there is sufficient historical experience with any particular type of brick, the test report requirement may be waived and no report need be submitted. Then omit 1.03, A, 2.

B. Prior to commencing the work, submit samples for review of specified materials listed below.*

1. Face Brick
2. Decorative Block
3. Acoustical Block
4. Brick Pavers
5. Structural Glazed Facing Tile
6. Colored Mortar

* List only those samples which you actually want to see prior to installation.

1.04 PRODUCT HANDLING AND STORAGE:

A. Protect masonry materials before and during installation and protect the work and materials of all other trades installed in masonry construction. Packaged materials shall be clearly identified by name.

B. All masonry materials to be delivered, stored, and maintained in a condition suitable for the particular use of those materials in the project.

ASSIGNMENT SHEET #9

1.05 QUALITY ASSURANCE:

A. During the periods when masonry work is being performed, provide one skilled mason who shall be assigned to direct the work of this Section.

B. In the event of damage to masonry, make all repairs and replacements necessary to the approval of the A/E and at no additional cost to the Owner. The intent of this Section is to have the party responsible for the damage be responsible for the cost of repair (see General Conditions).

1.06 REFERENCES:

A. "Specification for the Design and Construction of Load-Bearing Concrete Masonry," published by the National Concrete Masonry Association (NCMA).

B. "Building Code Requirements for Engineered Brick Masonry," Brick Institute of America (BIA).

C. "Building and Heating Ventilating and Air Conditioning Code," Wisconsin Administrative Code ("Building Code").

D. "Recommended Practices and Guide for Specifications for Cold Weather Masonry Construction," International Masonry Industry All Weather Council.

A/E NOTE: Two sections 1.07 are given, *only one should be used.* The first gives requirements for prism testing, the second for the unit strength method. Prism tests are normally used for large projects involving load-bearing masonry. The unit strength method is used for medium projects or where prism testing may be impractical. The State Code requires that one of these two methods be used if there is tension somewhere in the wall. The unit strength method is conservative due to the fact that the strength of the masonry in the wall is based only on the strength of the unit. If Empirical Method is used for design (no tension anywhere), delete Section 1.07.

1.07 PRISM TESTING:

A. These requirements generally meet NCMA or BIA. The required 28 day strength, f'm, is shown on the Drawings for each class of masonry construction. The actual strength of the masonry construction shall be determined by the prism method.

ASSIGNMENT SHEET #9

B. One prism test consisting of three (3) specimens for each class of masonry shall be made in advance of construction to confirm f'm. Prisms made at the job site shall be carefully handled so as to preclude damage during both handling operations and transportation to testing lab per ASTM E-447.

1. Of the three specimens used in the advance test, two shall be tested at 28 days and one shall be tested at 7 days.
2. As a part of the advance test procedure, six (6) 2" × 2" × 2" mortar cubes shall be fabricated and tested with the three (3) prism specimens. Two tests shall be at 7 days and four at 28 days.
3. As a part of the advance test procedure, tests on three (3) masonry units shall be made at the same time as the 28 day prism test.

C. After prism testing and during the construction process, additional prism tests will be required. Prism tests are as defined in 1.07 B, and one test shall be made for each 5000* square feet of wall constructed. Subject to written approval of the A/E, tests of units and mortar cubes may** be made in lieu of prism tests. Cubes shall be as in 1.07 B., 2 above. Three (3) unit tests will be required at the testing of each set of mortar cubes. For bidding purposes, assume that prism tests will be required during the construction phase.

* A/E may increase area during progress of work.

** A/E may substitute the word "will" if the project warrants. Then delete last sentence.

1.07 UNIT STRENGTH METHOD TESTING:

A. These requirements generally meet NCMA or BIA. The required 28 day strength, f'm, is shown on the Drawings for each class of masonry construction. The actual strength of the masonry shall be determined by the unit strength method.

B. In advance of construction, test three (3) masonry units identical to those to be used in the work. Test these three (3) units in accordance with relevant procedures outlined in ASTM C67. The average of the three (3) tests shall be the defined unit strength corresponding to the stated f'm unless any test deviates from the average by more than 500 psi in which case another unit shall be tested until three (3) successive tests meet the above criteria. The unit strength must meet requirements of either NCMA or BIA Standards as applicable.

ASSIGNMENT SHEET #9

1.08 SAMPLE PANELS:

A. Furnish an adequate number of production run brick for each type brick that will be used on this project to construct a sample panel of size, pattern and jointing shown on the Drawings. Panel will illustrate the color, range, texture, bond, joints, tooling, workmanship and mortar color and be representative of the masonry work to be constructed on this project.

B. Contractor is obligated to construct only one sample panel for each type of face brick as a part of this work. In the event that Owner and/or A/E reject this panel, the Contractor shall construct additional panels to be paid for by the Owner at a cost of $__________* per panel.

C. Do not start brick work until A/E and Owner have both provided written acceptance of the panel.

D. Accepted panel shall remain on site until all masonry work is completed on project. Panel to be used as a standard of comparison for masonry work to be constructed. Masonry work shall be deemed acceptable if the actual work on the project is comparable, within reasonable industry standards to the masonry of the sample panel.

E. Remove sample panel from site after all work is completed and dispose of panel.

* A reasonable cost of an additional panel is about $200.00.

1.09 MORTAR TESTS:

The A/E may at his sole discretion order tests on mortar at any time during the construction to insure compliance with the Property requirements of 2.02B. even though laboratory test data has been submitted. Mason contractor shall cooperate with the testing laboratory during the taking of samples.

PART 2.00 — PRODUCTS

2.01 GENERAL:

A. Units shall be free from major cracks, laminations, or other defects which would affect structural performance or appearance in accordance with ASTM Standards. Used units are not permitted except with written approval of A/E. Concrete masonry units shall be marked to identify manufacturer.

ASSIGNMENT SHEET #9

2.02 MORTAR:

A. Mortar shall contain cementitious materials, aggregates, and water and shall comply with the Property Requirements of 2.02 B. herein. Submit test data from a certified testing laboratory that tests, made not more than six months prior to the date of bid submittal, show that the mix used which contains the same type of aggregates to be used on this project, will meet the appropriate property strength requirement.

B. Mortar property requirements for laboratory prepared mortar:

MORTAR TYPE	COMPRESSIVE STRENGTH	WATER RETENTION	MAXIMUM AIR CONTENT
M	2,500	75	18
S	1,800	75	18
N	750	75	18

C. Mortar shall conform to 2.02 B and to other requirements of ASTM C-270. The ASTM Proportion Specifications method whereby mortar proportions are selected by volume is deleted from this Specification. Ingredients shall also meet requirements listed below.

1. Aggregates shall conform to ASTM C-144.
2. Water shall be clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, and other deleterious substances. In all cases water from a municipal water supply will be acceptable.
3. Admixtures are not permitted without written approval of the A/E. Such approval may be given upon written request during the bidding or negotiating period.
4. Accelerators may be used where metal ties, anchors, reinforcement, or other embedded metal items are installed in masonry construction.
5. Cementitious materials:
    a. Portland cement shall conform to the requirements of ASTM C-150, Type I or Type III.

ASSIGNMENT SHEET #9

b. Masonry cement shall conform to requirements of ASTM C-91. The following brands are acceptable:*

Other brands may be accepted upon request and subsequent written approval of the A/E. Use only one brand on this project.

c. Hydrated lime shall conform to the requirements of ASTM C-207, Type S.

d. Gypsum shall conform to the requirements of ASTM C-22.

e. Premix Mortar: ASTM C-387, Type __________ (M, S, N).

* Insert brands.

D. Mortar shall be used in accordance with the following table.

MASONRY USE	MORTAR TYPE PERMITTED
Masonry in contact with the earth	M or S
All other load-bearing masonry	See drawings
Non-load-bearing masonry	M, S, or N
Fireproofing	M, S, N, or gypsum
Firebrick	M, fireclay
Backplastering* walls in contact with earth	M
Parging*	Same mortars as used in wall

* A/E — you may restrict use or eliminate certain mortars as required.

E. Mortar for brick shall be colored, color to be selected by A/E. Cost allowance to be $__________* per bag.

* A/E add cost. Omit if coloring agent is used. See 2.12.

ASSIGNMENT SHEET #9

2.03 STRUCTURAL GROUT:

A. Structural Grout shall conform with the requirements of ASTM C476, the suggested proportions for which are, 1 part cement, 3 parts sand and 2 parts pea gravel mixed to produce pouring consistency without segregation.

2.04 BRICK:

A. Brick shall be made from clay, shale, fire clay, or mixture thereof and fired to incipient fusion. Brick for exterior use shall meet the durability requirements of ASTM C216, Grade SW (24 hour absorption, 5 hour boil, saturation coefficient) whether or not strength exceeds 8000 psi. If 24 hour absorption is less than 8 percent, the requirements for saturation coefficient shall be waived. Brick manufacturer shall certify the absorption for brick supplied. See 1.03 A-2.

B. Face Brick

1. Face brick shall comply with ASTM C216, Grade SW, Type FB*.

* A/E insert FBS, FBX or FBA as appropriate.

(NOTE: There are two subparagraphs No. 2. Use only one as appropriate.)

2. Face brick shall be ________________________________ ** as
manufactured by ____________________________________,
and distributed by ___________________________________.

** A/E give size (actual dimensions, wall thickness/height/length, brand, mfr., etc.

2. Provide cash allowance of $__________ per thousand, *plus applicable sales tax* delivered F.O.B. job site, and unloaded. Packaged or palletized brick at manufacturer's option. Should cost of brick be more or less than the allowance, the amount of the contract is to be adjusted accordingly, based on the actual number of brick required for the work and the price of the delivered brick. Brick dimensions shall be ____________________.

C. Hollow Brick

1. Hollow brick shall conform to ASTM C-652, Grade SW, Type HB***.

*** A/E insert HBX, HBS or HBA as appropriate.

(NOTE: There are two sub-paragraphs No. C2. Use only one as appropriate.)

ASSIGNMENT SHEET #9

2. Hollow brick shall be ________________________________ * as manufactured by ________________________________, and distributed by ________________________________.

* A/E insert brand, manufacturer, etc.

2. Provide cash allowance of $__________ per thousand, *plus applicable sales tax* delivered F.O.B. job site, and unloaded. Packaged or palletized brick at manufacturer's option. Should cost of brick be more or less than the allowance, the amount of the contract is to be adjusted accordingly based on the actual number of brick required for the work and the price of the delivered brick. Brick dimensions shall be ____________________.

D. Building Brick shall comply with ASTM C62, Grade SW.

E. Brick having initial rate of absorption of more than 30 grams per minute per 30 square inches should be wetted sufficiently so that the rate of absorption when laid does not exceed that amount.

2.05 CONCRETE MASONRY UNITS:

A. Provide concrete block made with portland cement, aggregates, water, and admixtures of nominal 8" × 16" face by thickness shown — (actual dimensions 7 $^5/_8$" × 15 $^5/_8$"), and additional units of other shapes as required by the project conforming to the following requirements.

1. Hollow Core — ASTM C90, Grade N, Type II.*

2. Solid Blocks — ASTM C145, Grade N, Type II.*

3. Concrete Brick — ASTM C55, Grade N, Type II. (normalweight, lightweight).*

4. Decorative Concrete Block.

5. Prefaced Concrete Block: ASTM C744.

* Select normalweight or mediumweight or lightweight as appropriate.

B. Use units as follows:

1. ____________ units for all interior partitions.

2. Normalweight units for all below grade walls.

ASSIGNMENT SHEET #9

3. Textured or other special units to be used where shown on the Drawings.

4. Fire-rated concrete masonry units shall be used where indicated on the Drawings.

5. Three courses of brick or grouted hollow concrete block (including bond beams or grouted pilasters) (8 inches deep) to be used under concentrated loads, except loose lintels spanning 3′ - 8″ or less.

6. Bond beam blocks to be used for job cast concrete lintels and bond beams.

7. Use ____________ units for all exterior walls.*

8. Use three cell block for all grouted wall construction.

* NOTE TO A/E: All block, lightweight, mediumweight and normalweight may absorb water unless coated with a water-repellent coating. This should be required in Section 07175. Lightweight block is especially susceptible to this situation.

2.06 PRECAST CONCRETE LINTELS:

A. Provide precast concrete lintels as shown on Drawings. Concrete shall meet requirements of Section 03300.*

* A/E be sure to show where concrete lintels are required and reinforcement is required. Note that precast concrete may not match wall texture or color.

2.07 SETTING MATERIAL FOR BASE AND BEARING PLATES:

A. Mortar shall be same as used in wall construction.

A. Grout shall be **____ nonferrous, nonshrinking grout for use with base and bearing plates or other approved by A/E.

* Use either of the listed Sections A. Use grout only in special cases when mortaring in plates is not adequate for structural reasons. Show details of those locations where grouting is required.

** A/E insert brands.

ASSIGNMENT SHEET #9

2.08 REINFORCEMENT AND ANCHORAGES:

A. Reinforcement for Bond Beams and Lintels shall conform to requirements of Section 03200.

B. Continuous joint reinforcement for cavity walls, single wythe, and multiple wythe walls shall conform to the ASTM A82 with galvanized coating on cross wires per ASTM A116, Class 3 for exterior wall and wet area usage. Ties shall consist of at least 2 No. 9 gage longitudinal wires with No. 9 gage cross wires spaced not over 16 inches apart on each longitudinal wire. Cross wires shall be welded to longitudinal wires.

Ties shall be of such dimension that they engage both wythes in multiwythe construction and in all cases have an imbedment width about 2 inches less than the total wall thickness.

C. Anchors and ties* shall be zinc-coated ferrous metal of the types specified. Zinc coating ASTM A153, Class B-1, B-2, or B-3 as applicable. Copper cladding of steel wire shall conform to the requirements as specified for Grade 30 HS wire in ASTM Specification B227.

* A/E select proper type depending on what is involved such as brick to wood, brick to masonry.

1. Wire mesh ties shall be 1/2 inch mesh of steel wire minimum 16 gage. Ties shall be minimum 12 inches in length, and one inch less in width than the wall in which placed.
2. Rigid-steel anchors shall be 1 1/2 inches by 1/4 inch with ends turned up minimum 2 inches, not less than 24 inches long.
3. Cavity wall ties shall be of 3/16 inch diameter, formed in rectangular shape 4 inches wide for hollow units laid with cells vertical and U or Z shape for solid units. Length of ties minimum 6 inches.
4. Dovetail anchors and anchor slots shall be minimum 16 gage, 1 inch wide, and turned up 1/4 inch at outer end.
5. Corrugated or crimped metal ties: Sheet steel not less than 7/8 inch wide; 22 gage in thickness, 6 inches in length.

NOTE TO A/E: No joint reinforcement shall be used when calcium chloride is permitted. Use running bond and control joints per Wisconsin Code unless detailed otherwise on Drawings since code requirements are minimum.

ASSIGNMENT SHEET #9

MASONRY

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2.09 THROUGH-WALL FLASHING:

A. Plastic sheet flashing shall be ______________________________.

B. Copper/Kraft Paper Flashing shall be ______________________________.

C. Lead/Kraft Paper Flashing shall be ______________________________.

D. Aluminum/Kraft Paper Flashing shall be ______________________________.

E. Plastic/Kraft Paper Flashing shall be ______________________________.

F. Preformed Metal Flashing shall be ______________________________.

2.10 INSULATION MATERIALS:*

* Normally a brand is selected.

A. Water-repellent loose-fill masonry insulation.

1. Perlite: Federal Specification HH-I-574a.
2. Vermiculite: Federal Specification HH-I-585.
3. Crushed Polystyrene:

B. Rigid board-type insulation: Thickness shall be ____________________ inches to provide an R value of __________.

1. Mineral fiber board: Federal Specification HH-I-562, Type I, Class 2 as manufactured by ______________________________.
2. Extruded polystyrene: Federal Specification HH-I-524a, Type II, Class B, ASTM C578, Type II, Grade 2 as manufactured by __________.
3. Molded polystyrene: Federal Specification HH-I-524a, Type I, Class A, ASTM C578, Type I, Grade 2 as manufactured by ______________.

C. Adhesives for adhering rigid board insulation to masonry shall be types recommended by insulation manufacturer.

ASSIGNMENT SHEET #9

D. Compressible Joint Filler

1. At fire walls use noncombustible filler.
2. At other walls use Polystyrene, or fiberglass.

2.11 SPECIALTY MASONRY ACCESSORIES:

A. Provide masonry accessories as indicated on Drawings as follows:

1. Masonry anchor where masonry abuts concrete walls or columns.
2. Masonry ties where masonry abuts steel columns or steel beams.
    a. Welding ties.
    b. Flexible anchors.
3. Control joint material; plastic, PVC, Neoprene.
4. Joint Filler: Manufactured by ______________________________.
5. Cleanout doors.
6. Brick or foundation vents.
7. Access doors.
8. Weep hole material; rope wicks, metal louvers.

* Note: All accessories that could be provided are listed in this Section of this guide specification.

2.12 MORTAR COLORING AGENT:

A. Mortar Coloring Agent shall be Mineral Oxide Pigment Type __________, color manufactured by ____________________, and shall not exceed 6 percent by weight of cement except for carbon black, which shall not exceed 3 percent by weight of cement. Water soluble material shall not exceed one percent by weight of cement.

(See also 2.02 E.)

ASSIGNMENT SHEET #9

2.13 CONTROL JOINT RESILIENT KEYS:

A. Control joint resilient keys: Factory-fabricated solid section of natural or synthetic rubber, combination thereof, plastic, or other rubberlike material. Durometer hardness shall be not less than 70 when tested in conformance with ASTM Specification D2240. The key shall be of the shape indicated and of dimensions to fill completely and fit neatly, but without forcing, into masonry-unit jamb-sash grooves and to provide control-joint width of 3/8 inch with tolerance of 1/6 inch. Shear section shall be 5/8 inch minimum thickness.

2.14 EXPANSION JOINT MATERIALS:

A. Expansion joints shall be provided in locations shown on the plans. Use*

____

____.

* A/E insert (20 oz. Copper, Premolded Rubber, Neoprene, Extruded Plastic and give mfr. where applicable).

2.15 ROPE WICK:

Use cotton rope of approximately 1/4" diameter. Nylon is not permitted unless it is used to form the cavity and is removed.

PART 3.00 — EXECUTION

3.01 SURFACE CONDITIONS:

A. Inspection:

1. Prior to work of the Section the mason contractor shall inspect related installed work of other trades, notify the general construction contractor who shall verify that such work is complete to the point where portions of the masonry installation may properly commence.

2. Verify that unit masonry may be completed in accordance with the referenced standards and the contract documents.

B. Discrepancies:

1. In the event of discrepancy noted while performing A. above, immediately notify the general construction contractor and the A/E in writing.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been completely resolved.

ASSIGNMENT SHEET #9

3.02 COORDINATION:

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.03 PLACING TOLERANCES:

A. Walls to be erected in accordance with standard industry practices and written guidelines of ACI Standard for concrete masonry and BIA Standards for brick masonry.

3.04 MIXING MORTAR:

A. Mix mortar ingredients in a mechanical batch mixer for at least 3 minutes to produce a workable consistency but not over 5 minutes.

B. Use mortar within two (2) hours of mixing at temperatures over 76 degrees F and two and one-half hours at temperatures under 40 degrees F.

C. Retempering of mortars that have stiffened due to water loss through evaporation shall be accomplished by adding water to restore required consistency. Do not retemper after mortar has achieved initial set.

D. Colored mortar shall be mixed to produce uniform color throughout.

3.05 INSTALLATION — GENERAL

A. Lay up all walls in one-half lap running bond pattern unless noted otherwise on Drawings. Align joints vertically in alternate courses.

B. Fully bond external and internal corners and intersections unless shown otherwise.

C. Except for head joints used for weep holes or ventilation, all masonry units shall have full head joints.

D. Bedding requirements:

   1. First course of all walls shall have full mortar bedding, except for the following situations:*

* There are occasions where face shell bedding would be used for the first course of walls such as 6″ or 8″ through wall units.

ASSIGNMENT SHEET #9

MASONRY

Section 04200 — Page 17

2. Unless otherwise noted on the Drawings, the following mortar bedding shall be used for all masonry construction.

Concrete units	
Hollow units	Face shell bedding
75% solid units	**______________________
Solid units	**______________________
Grouted hollow	**______________________
Brick all units	Full mortar bedding

** A/E — insert fully bedded or face shell bedded. Fully bedded for piers and elements where grouting is for tension development of bars.

E. Horizontal and vertical joints shall be 3/8 inch thick unless otherwise indicated.

F. Provide weep holes of 3/8 inch minimum diameter in exterior walls above all flashings, at lintel angles, and at bases of walls at _____* o.c.

* Select spacing to fit masonry units used. Open head joints preferred.

G. Isolate masonry partitions from vertical structural framing members by a control joint of not less than 1/2 inch regardless of joint treatment. Take special care to see that mortar does not fall into space between wall and such structural member, thereby eliminating the ability of the wall to act independently from the structural member.*

* This may also be accomplished by wrapping columns with insulation.

H. Finish/Tooling for all joints on exterior and interior exposed walls shall be *________________________________.

* Raked to 1/4" depth, tooled with 5/8" rod or sled with maximum depth of 1/8", flush, squeezed. Use raked joints on exterior masonry, only after proper consideration of moisture penetration.

ASSIGNMENT SHEET #9

I. Do not tap masonry after mortar has taken initial set. Where adjustments are required, remove mortar and replace unit.

J. Buttering corners of head joints and deep or excessive furrowing of mortar joints is not permitted.

K. Where non-load-bearing partitions extend to underside of floor, roof deck, or structural members, stop masonry *______ inches short to allow for deflection. Fill gap with joint filler. Keep joint filler 1/2 inch back from both faces of wall. Use non-combustible joint filler material at fire walls.

* Insert number of inches.

L. If calcium chloride is being used on the project, mortar with calcium chloride shall not be placed adjacent to the structural metals, structural framing, hollow metal door frame and window frames. These areas will require mortar without calcium chloride.

3.06 TIME REQUIREMENTS FOR PLACING LOAD-BEARING MASONRY:

A. Placement of loads (i.e. floors and upper walls) on completed section of masonry construction shall not proceed until *______ days have elapsed from the completion of that particular construction. Placement of such loads may be made in advance of this time period subject to the approval of the A/E and provided that prism tests show that the construction has achieved sufficient strength.

* Insert number of days.

3.07 LAYING CONCRETE MASONRY UNITS:

A. Saw cut concrete masonry units requiring cutting, trimming, or mitering to provide units without spalled or chipped edges.

B. Cut and fit masonry units accurately around pipes, ducts, grills, columns, openings, metal frames, etc., and slush voids full.

C. Provide openings in partitions for sheet metal ducts, grills, and other openings required by other trades. Point up joints between masonry and metal work.

D. Set masonry tightly to hollow metal frames as detailed and slush full all voids between masonry and frame and build anchors into joints.

ASSIGNMENT SHEET #9

E. Where electrical outlets or boxes occur, cut accurately around boxes and fill in solidly around all boxes.

F. Exercise care in laying units to keep them clean and wipe off mortar spatterings as units are laid up.

G. At intersections and corners for walls laid simultaneously, lap at least 50 percent of the units. Walls laid separately require reinforcement per Section 3.09.

3.08 LAYING BRICK UNITS:

A. Lay out brick work so that coursing heights will work out to number of courses per story as detailed on Drawings. Where conditions require, include cut brick to maintain pattern.

B. Walls exposed to weather on both sides shall be constructed entirely of face brick. Where one face is covered with roofing or flashing, covered face may be face brick culls, subject to A/E approval.

3.09 PLACING REINFORCEMENT AND METAL TIES IN CONCRETE MASONRY:

NOTE: Do not use wall reinforcement if you intend to permit calcium chloride.

A. General:

1. All reinforcement and ties shall be fully embedded in the mortar and have minimum $^5/_8$" cover. Continuous joint reinforcement shall lap a minimum of *________ inches at splices.

* Engineer insert lap required.

B. Single wythe walls:

1. Provide continuous joint reinforcement in walls (per 2.08 B.) at vertical intervals not exceeding 16". Reinforcement shall be set into the mortar bed.

NOTE: In winter where accelerators containing calcium chloride are used, leave out reinforcement and use running bond plus additional control joints.

ASSIGNMENT SHEET #9

C. Multiwythe walls:

1. Bond adjacent wythes with (1) continuous metal ties spaced at vertical intervals not exceeding 16" or (2) individual ties the equivalent of not less than 3/16" diameter steel rods with one tie for not more than each 4 1/2 square feet of wall. Ties in alternate courses shall be staggered. Maximum vertical distance between ties shall not exceed 18" and the maximum horizontal spacing shall not exceed 36". In multiwythe walls with an air space, provide additional ties within 12" of all openings at spacings not to exceed 36".

2. Use 90 degree bent ties with hollow units and rectangular or Z-shaped ties for solid units.

NOTE: Multiwythe walls cannot be constructed with calcium chloride. (They may have metal ties but metal ties are illegal with calcium chloride being used.)

D. Anchoring to structural members:

1. Ensure that anchorages embedded in concrete or attached to structural steel members are properly placed. The free end of these anchorages should be embedded in every second joint.*

* A/E may require closer spacing.

E. Provide horizontal wall reinforcement in first course above and below all openings. Extend this reinforcement a minimum of 2' - 0" beyond all corners of openings where wall construction exists.

F. Intersections and corners:

1. Walls laid simultaneously are to be masonry bonded per 3.07 G.

For walls laid in separate placing operations and are:

1. Load-bearing, use the equivalent of 1 1/4" by 1 1/4" anchors with ends turned up not less than 24" between turned ends, embedded into each wall and spaced not more than 2' vertically.

2. Non-load-bearing, use the equivalent of corrugated or crimped metal ties 6" or more in length, embedded equally into each wall and spaced not more than 16" vertically.

   a. Where regularly toothed or blocked, the vertical spacing of anchors may be doubled.

ASSIGNMENT SHEET #9

G. For reinforced and grouted masonry piers and pilasters, place rebars in cavities and/or in cells of block. Rebars shall be centered in cell openings unless shown otherwise on the Drawings. *Rebar splices are permitted in accordance with the following. * ______________________________

____

____

* A/E insert appropriate comments such as "See Drawings."

3.10 PLACING REINFORCEMENT AND TIES IN BRICK MASONRY:

A. Brick veneer shall be attached to its backing using the equivalent of corrugated or crimped metal ties spaced at not more than 16" o.c. both horizontally and vertically.

B. When brick masonry has concrete block backup, use wall ties embedded 16 inches on center vertically and 36 inches on center horizontally. At openings place ties at 3' on center around openings and within 12" of opening.

-OR-

B. Secure face brick to concrete backup with dovetail anchors placed at 16 inches on center vertically and 36 inches horizontally.

3.11 INSTALLING CONTROL JOINTS:

A. Provide expansion and control joints as shown on Drawings. Sealants will be by Sealant Contractor.

B. Control joints shall extend through bond beams unless otherwise indicated.

3.12 INSTALLING EXPANSION JOINTS:

Install expansion joint materials in locations shown on plans and as detailed. Where a proprietary product is used, it shall be installed in strict accordance with manufacturer's recommendations.

3.13 FILLING BOND BEAMS AND LINTELS:

A. Bond Beams and lintels spanning more than 3' - 8" shall be filled with either structural grout or high-slump concrete.

B. Lintels spanning 3' - 8" or less may be filled with mortar but preferably should be filled with grout.

C. Allow concrete, grout or mortar to cure a minimum of *________ days before removing temporary supports.

* A/E insert number of days.

3.14 FILLING PIERS, PILASTERS AND GROUTED WALL CONSTRUCTION CAVITIES:

A. Prior to filling piers, pilasters or wall cavities, remove from cavities and/or cells, all debris, mortar and any material which would interfere with the proper and total filling of these cavities and cells.

B. Fill piers and pilasters with structural grout or high-slump concrete. Thoroughly work material into cavities and cells, using internal vibration. Grouted wall construction, cells or cavities shall be filled with structural grout, which shall be thoroughly compacted and vibrated to consolidate the grout. These elements shall not be filled with mortar.

C. Grouted wall construction (cells and or cavities) shall be filled with structural grout in locations shown on the Drawings.

3.15 SETTING BASE AND BEARING PLATES:*

A. For those base and bearing plates set by masons, place (grout) (mortar) under plates to thoroughly fill all the space under the plates. Plates to be set level.

* Coordinate with 2.07.

3.16 PILASTERS:

A. Where pilasters are called for on the Drawings, the projecting portion of the pilaster shall be integrally bonded by alternate course bonding of the masonry units or use of special pilaster blocks.

B. The pilaster section shall also be integrally bonded or mechanically keyed to the adjoining wall by alternate course bonding or use of special pilaster blocks.

3.17 FLASHING INSTALLATION:

A. Install flashing type as indicated on Drawings and flashing furnished by other sections of the work in accordance with manufacturer's recommendations.

B. Set flashing to divert water to outside of wall. Seal or lock laps and adhere in place, seal at vertical surfaces. Seal punctures around ties with manufacturer's recommended adhesive. Flashing shall be watertight.

ASSIGNMENT SHEET #9

3.18 INSTALLATION OF INSULATION:

A. Installing loose fill insulation. Masonry cell insulation shall be placed in cells as masonry is being laid. Fill cells after placing a maximum of *________ block courses as work progresses.

* The number of courses shall be a maximum of 6 courses for poured insulation and up to one story for foam insulation.

B. Installing rigid board insulation. Cavity wall insulation shall be cut to fit around obstructions and reinforcing. Fill voids with insulation. Stagger vertical joints in double layer installation. Butt edges and ends tight.

3.19 BACKPLASTERING:

A. Backplaster walls with mortar to thickness shown. Backplastering to be done in two consecutive coats. Scarify first coat to insure bonding.

B. Remove projections and dampen masonry walls prior to backplastering. Where possible, backplaster when walls are completed to provide a continuous watering.

C. Trowel to a smooth surface.

3.20 PARGING:

A. Parge walls in one coat with mortar to thickness and where shown on Drawings as walls are being built. Trowel to a smooth surface.

3.21 INSTALL ITEMS FURNISHED BY OTHERS TRADES:**

A. Contractor furnishing any of the listed items shall be responsible for locating the item in the field unless location is shown on Drawings.

1. Loose lintels and corner guards.
2. Anchors.
3. Anchor bolts.

** Section 01040 "Cutting and Patching" should contain a statement to the effect that the person cutting a hole is required to patch it at his own expense and that he must use the mason contractor on the job for that patching work.

ASSIGNMENT SHEET #9

4. Inserts.
5. Air conditioner sleeves.*
6. Bearing plates, base plates, for items to be installed in masonry.
7. Louvers, frames, and grills.*
8. Access panels.*
9. Fire extinguisher cabinet sleeves.*
10. Hose cabinet sleeves.
11. Metal flashings and expansion joints.

* These items are *sometimes* installed by masons.

3.22 BUILT-IN ITEMS FURNISHED AND INSTALLED BY OTHER TRADES:

A. Air conditioner sleeves.

B. Louvers, Frames and Grills.

C. Access Panels.

D. Fire extinguisher cabinet sleeves.

E. Hose cabinet sleeves.

F. Prefabricated expansion joints.

G. Metal window frames (when not specified to be installed in other sections).

H. Metal door frames (when not specified to be installed in other sections).

Metal door frames to be installed plumb, level, square and in accordance with provisions of Steel Door Institute — SDI 100 requirements.

3.23 CONSTRUCTION OF WEEP HOLES:*

Carefully mortar in rope wick. Make sure wick is kept vertical. Take special precautions not to have excessive mortar droppings in area of wick. Remove wick after initial set to create unobstructed opening.

* A/E note: Show wick detail on Drawings.

ASSIGNMENT SHEET #9

3.24 PROTECTION DURING CONSTRUCTION:

A. Take whatever steps are required to brace walls during the construction period to withstand normal wind forces. Such bracing shall remain in place until permanent stability is achieved.

Permanent stability for this project will be considered to be functional when
*____
____
____
at which time wind bracing may be removed.

* ENGINEER NOTE: (e.g. joists are set, precast slabs are set, column x-bracing is in place, etc.).

B. Partially completed walls or the top of walls not enclosed or sheltered shall be covered by a strong, weather-resistant material or other suitable means at the end of each day or shutdown.

3.25 COLD WEATHER CONSTRUCTION:

A. Construction shall be in accordance with Wisconsin Code (53.33). This incorporates provisions of "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction" as follows:

1. When mean daily air temperature is anticipated to fall below 32 degrees F in the 24 hours following erection of masonry, use Type III cement.
2. If ice or snow has formed on masonry bed, it shall be thawed using heat until dry to the touch.
3. No work shall be constructed on frozen and/or damaged masonry.
4. While work is progressing:
   a. Use dry units only.
   b. For air temperature 40 degrees F to 25 degrees F, heat sand and water to achieve mortar temperature between 40 degrees F and 120 degrees F.
   c. For air temperature 24 degrees F to 20 degrees F follow requirements of a. and b. above plus apply heat to both sides of walls and construct wind breaks when wind velocity is above 15 mph.

ASSIGNMENT SHEET #9

d. For air temperature below 20 degrees F follow requirements of a., b., and c. above plus provide enclosure to maintain air temperature above 32 degrees F. Temperature of units shall not be less than 20 degrees F when laid.

5. Protection for completed masonry:

a. For mean daily temperature 40 degrees F to 25 degrees F, cover with weather-resistive membrane for 24 hours.

b. For mean daily temperature 25 degrees F to 20 degrees F, follow requirements of 2. above plus cover with insulating blankets for 24 hours.

c. For mean daily temperatures below 20 degrees F, maintain temperature of masonry above 32 degrees F for 24 hours by enclosure and supplementary heat or by electric heating blankets.

3.26 POINTING AND CAULKING:

A. At completion of masonry work and when directed, point up masonry and push pointing mortar into beds and joints full and solid. Fill nail holes with mortar.

B. Mason shall rake out mortar joints as required on detailed drawings and as specified to prepare control joints for caulking.

3.27 CLEANING:

A. Clean, point, and wash down brick and concrete block surfaces. Clean as units are being set and again upon completion. Use any cleaning agents in strict conformance with the manufacturer's instructions.

B. Remove surplus mortar and leave surface of all masonry clean and finished. Remove large particles of mortar with putty knife or chisel before cleaning walls. Remove sharp burrs on exposed block mortar joints with rubbing stone.

C. Remove shoring, supports, centering, scaffolding, mason's wedges, false work, and protection. Remove mortar spatterings from sills, walls, and finished work of other trades and contractors. Take special care during cleaning operations not to damage glass, window frames, shrubbery or other similar completed adjacent construction.

END OF SECTION

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BASIC PLAN READING
UNIT III

ASSIGNMENT SHEET #10 — INTERPRET A FINISH SCHEDULE

NAME ________________________________ SCORE ____________

The finish schedule is an important part of construction plans. Completing this assignment sheet will give you practice interpreting a finish schedule.

Using the finish schedule below, answer the questions on the following page.

FINISH SCHEDULE

DOOR SCHEDULE

Symbol	Width	Height	Thickness	Material	Type	Quantity	Threshold	Remarks	Manufacturer
2668	2'-6"	6'-8"	1 3/8"	Wood-with vents	Slab core	3	None	Oil stain	
3068	3'-0"	6'-8"	1 3/8"	Wood-mahogany	Slab core	1	None	Oil stain	
3068	3'-0"	6'-8"	1 3/4"	Metal clad		1	Concrete	Pre-finish	
3868	3'-8"	6'-8"	1 3/4"	Alum. & glass	Ins. plate glass	1	Aluminum	None	
Over-head	16'-10"	12'-2"				1	None	Oil stain	Clopay-Model 900

WINDOW SCHEDULE

Symbol	Width	Height	Screen	Material	Type	Quantity	Remarks	Manufacturer	Catalog number
A	1'-8"	3'-8"	No	Aluminum	Casement	2-double			
B	6'-0"	4'-0"	No	Glass	Glass block	1		Stillburg plate glass	

ROOM FINISHES

Rooms	Floors				Ceilings			Walls				Base			Trim			Remarks
	CERAMIC TILE	RUBBER TILE	CARPET	CONCRETE	ACOUSTIC TILE	WOOD	NONE	WOOD PANEL	WALL-BOARD	WALL-PAPER	PAINTED BLOCK	CERAMIC TILE	CERAMIC TILE	WOOD	RUBBER	WOOD	PLASTIC	
Office			✓		✓			✓						✓		✓		Owner will choose carpet; walnut wainscot
Break Rm.		✓					✓		✓		✓				✓	✓		Use water-resistant finish
Women's Rm.	✓				✓							✓	✓			✓		
Men's Rm.	✓				✓							✓	✓			✓		
Furnace Rm.				✓			✓					✓						
Warehouse				✓			✓				✓							Use water-resistant finish

ASSIGNMENT SHEET #10

A. Which areas have painted masonry wall units? ____________________

____

B. Which rooms have a ceiling? ____________________

____

C. Which areas have exposed concrete floors? ____________________

____

BASIC PLAN READING
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A.	9/16"	F.	2 1/2"
B.	15/16"	G.	2 7/8"
C.	1 1/4"	H.	10 5/8"
D.	1 7/8"	I.	11 1/16"
E.	2 3/16"	J.	11 9/16"

Assignment Sheet #2

A.	1'-0"	F.	5 1/2"
B.	1/4"	G.	6 3/4"
C.	1 1/2"	H.	8"
D.	2 1/4"	I.	10 1/4"
E.	4"	J.	11 1/4"

Assignment Sheet #3

A.	10 1/2"	E.	2' - 0"
B.	7"	F.	3' - 6"
C.	3 1/2"	G.	5' - 0"
D.	1"	H.	6' - 0"

Assignment Sheet #4

A.	3"	F.	9' - 6"
B.	1' - 6"	G.	11' - 0"
C.	2' - 6"	H.	13' - 0"
D.	4' - 6"	I.	13' - 6"
E.	7' - 0"	J.	15' - 6"

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #5

A. 2′ - 0″

B. 5′ - 0″

C. 7′ - 0″

D. 9′ - 0″

E. 12′ - 0″

F. 14′ - 0″

G. 18′ - 0″

H. 22′ - 0″

I. 25′ - 0″

J. 28′ - 0″

Assignment Sheet #6

PART I

A. 49′ - 8″ x 69′ - 8″

B. Southwest corner of property line and existing sidewalk

C. 99.75

D. 1.75

E. 1/8″ = 1′ - 0″

PART II

A. 4 including overhead

B. 3500#

C. 4″ partition

D. 4′ - 10″ x 6′ - 10″

E. 2

PART III

A. 17′ - 0″

B. 6″ galvanized metal

C. #1 standard face brick

D. 19′ - 8″

E. Glazed tile

ANSWERS TO ASSIGNMENT SHEETS

PART IV

A. 12H4

B. 3/4" x 18"

C. #1 standard face brick

D. Styrofoam

E. Two sizes are used, 7 1/2" x 3 1/2" x 3/8" steel and 3 1/2" x 3 1/2" x 3/8" steel

PART V

A. Concrete, brick and stone

B. 2' - 0" OC

C. 6 - 6 x 10 - 10

D. 8" x 1' - 2"

E. 6' - 8" x 6' - 8"

Assignment Sheet #7

A. 23

B. 3' - 0" on center

C. 17' - 0"

D. #5 - (5/8")

E. In wall below window sills and on roof at the walls

F. Corrugated steel

G. Acoustic tile

H. Steel channel with poured reinforced concrete

I. 5 ply built up

J. 8' - 0"

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #8

A. 69′ - 8″

B. 20′ - 2″ × 20′ - 2″

C. 12″

D. 3′ - 8″ × 6′ - 8″

E. 61 square feet

F. 3½″

G. Ceramic tile

H. Glass block

I. —+

J. 2′ - 6″ × 6′ - 8″ = door size

Assignment Sheet #9

A. Answer should include any four of the following

1. Face brick
2. Decorative block
3. Acoustical block
4. Brick pavers
5. Structural glazed facing tile
6. Colored mortar

B. Three

C. 2″ × 2″ × 2″

D. 1. One for each type of face brick

2. $200.00

ANSWERS TO ASSIGNMENT SHEETS

E.
1. 2,500 psi
2. 75%
3. 18%

F.
1. M or S
2. M, S, or N
3. M, fireclay

G.
1. 1 1/2" × 1/4" × 24" with ends turned up minimum of 2 inches
2. 16 gage × 1" and turned up 1/4 inch at outer end
3. 7/8" × 22 gage × 6"

H. Answer should include any three of the following
1. Plastic sheet
2. Copper/kraft paper
3. Lead/kraft paper
4. Aluminum/kraft paper
5. Plastic/kraft paper
6. Preformed metal

I. Answer should include any three of the following
1. Masonry anchors
2. Masonry ties
    a. Welding ties
    b. Flexible anchors
3. Control joint material
4. Joint filler
5. Cleanout doors

ANSWERS TO ASSIGNMENT SHEETS

   6. Brick or foundation vents

   7. Access doors

   8. Weep hole material

J. Answer should include any three of the following

   1. Structural metals

   2. Structural framing

   3. Hollow metal door frame

   4. Window frames

   5. Reinforcing steel

K. 5/8"

L. Structural grout or high slump concrete

M. Scarify first coat

N. Strong weather-resistant material or other suitable means

O. Heat sand and water to achieve mortar temperature between 40°F and 120°F

Assignment Sheet #10

A. Warehouse, break room

B. Office, women's room, and men's room

C. Warehouse, furnace room

BASIC PLAN READING
UNIT III

TEST

NAME ________________________________ SCORE ______________

1. Define *plan.* ____

____

____

____

____

2. Define *construction drawings.* ____

____

____

____

____

3. Match terms associated with basic plan reading to their correct definitions. Write the correct numbers in the blanks. Terms and definitions are continued on the following page.

______a. Process of filling masonry units and between units with a cement and sand mixture to help strengthen units

______b. Graphic representation shown with lines and symbols

______c. Drawing that shows complete detailed information for an element of construction

______d. Drawing representing an object that has been cut to show internal construction

______e. Reproductions of architect's drawings

______f. Continuous horizontal layer of units, bonded with mortar

1. Section
2. Architectural drawing
3. Detail
4. Course
5. Blueprints
6. Grouting

TEST

______g. Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

______h. Detailed set of written instructions that supplements the drawings; describes material and equipment used in the structure as to quality and type, and becomes part of the contract

______i. Set of conventional symbols covering all lines used in drawings

______j. Arrangement of lines and figures indicating actual size of the object represented

______k. Drawing representing the front, side, or rear face of a structure, indicating what the building will look like when it is completed

______l. Sign that has been standardized and is used to represent an object or material

______m. Plastering masonry walls with mortar

______n. Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

______o. Stepped out courses in a wall that form a ledge; projection of stone or brick from face of wall

______p. Chart of materials and products

______q. Enlarged section drawing of bottom of a door or window

______r. Enlarged section drawing of top of a door or window frame

______s. Enlarged section drawing of side of a door or window frame

______t. Sequential grouting in separate steps or stages rather than grouting the entire length at once

7. Symbol
8. Elevation
9. Scale drawing
10. Specifications
11. Dimensions
12. Alphabet of lines
13. Head detail
14. Schedule
15. Staging
16. Corbel
17. Jamb detail
18. Architect's scale
19. Sill detail
20. Parging

TEST

4. Name types of pictorial drawings.

a. ______________________________

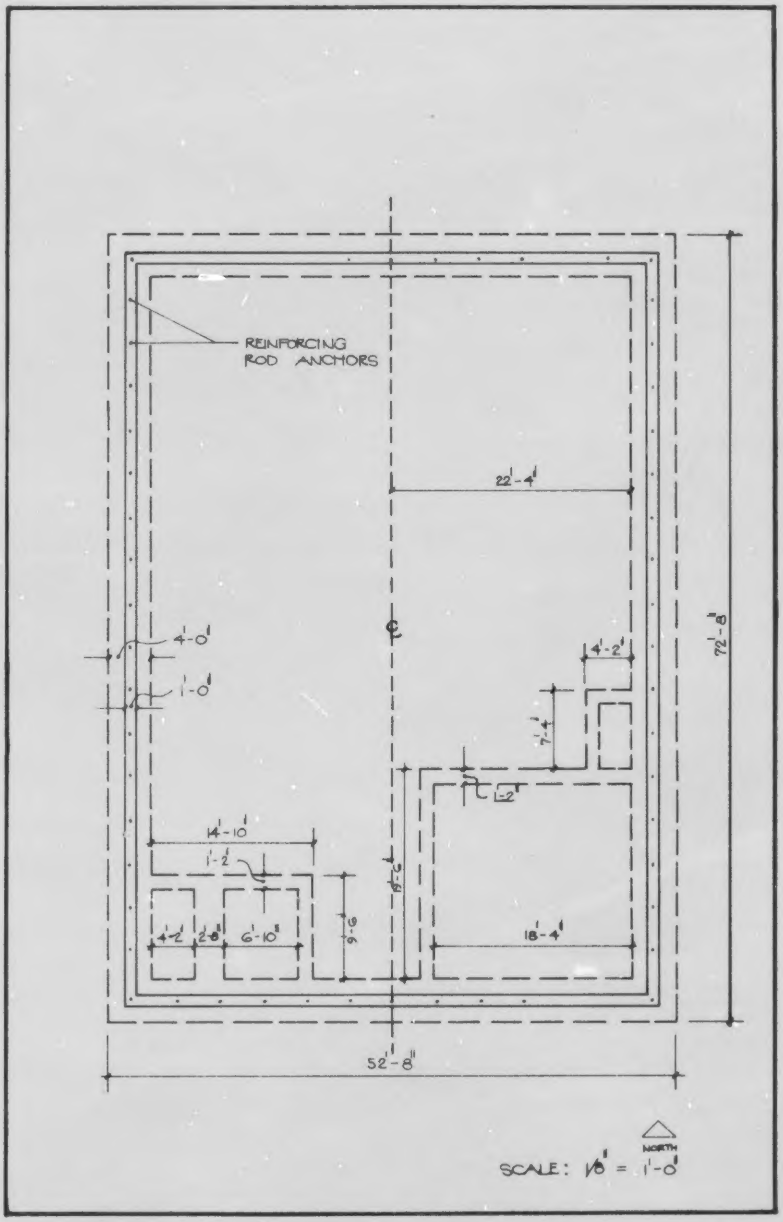
b. ______________________________

c. ______________________________

d. ______________________________

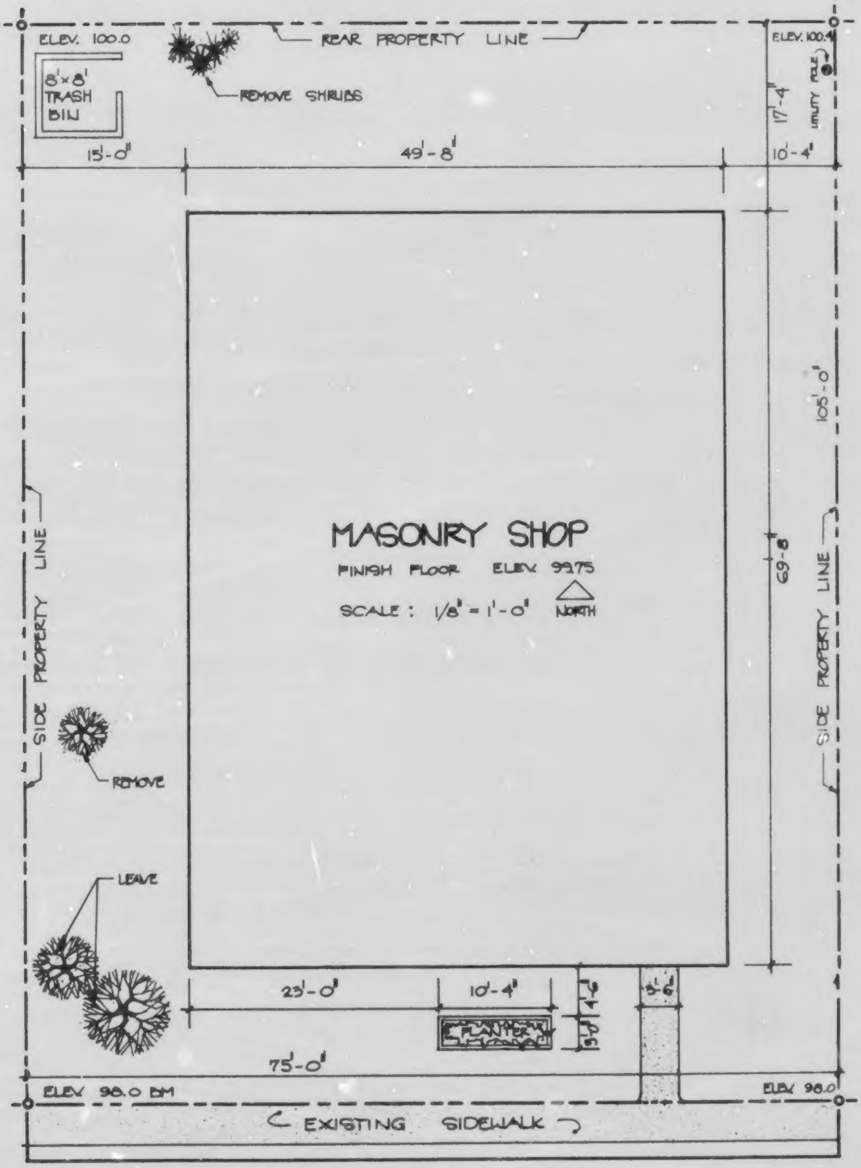
TEST

5. Label types of construction plans illustrated below and on the following pages. Write the correct names in the blanks provided.


REINFORCING ROD ANCHORS
22'-4"
℄
4'-0"
1'-0"
4'-2"
7'-4"
1'-2"
14'-10"
1'-2"
19'-6"
9'-6"
4'-2"
2'-8"
6'-10"
18'-4"
72'-8"
52'-8"
NORTH
SCALE: 1/8" = 1'-0"

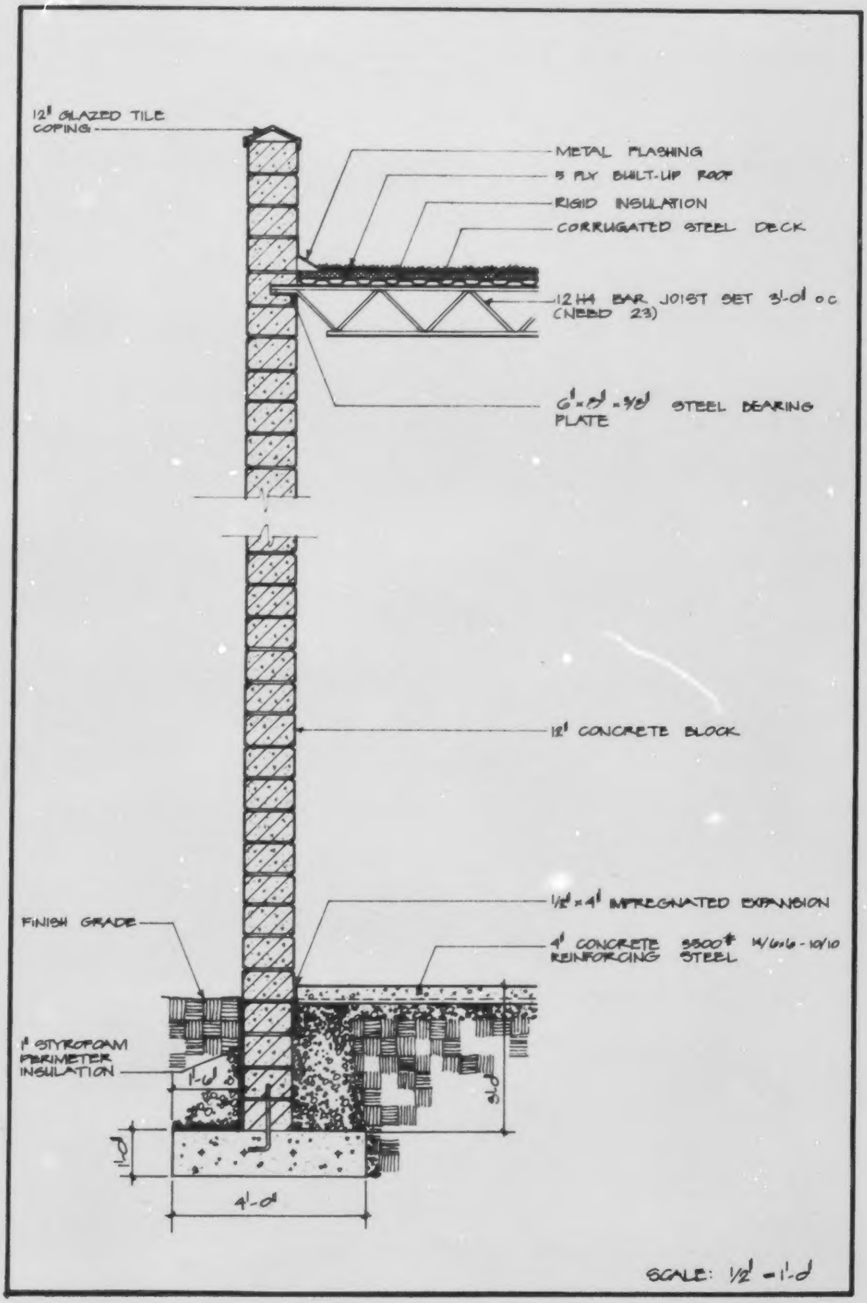
a. ______________________________

TEST


ELEV. 100.0
8'×8' TRASH BIN
REMOVE SHRUBS
REAR PROPERTY LINE
ELEV. 100.4
17'-4"
UTILITY POLE
15'-0"
49'-8"
10'-4"
105'-0"
69'-8"
SIDE PROPERTY LINE
MASONRY SHOP
FINISH FLOOR ELEV. 99.75
SCALE: 1/8" = 1'-0"
NORTH
SIDE PROPERTY LINE
REMOVE
LEAVE
23'-0"
10'-4"
4'-0"
3'-0"
3'-6"
PLANTER
75'-0"
ELEV. 98.0 BM
ELEV. 98.0
EXISTING SIDEWALK

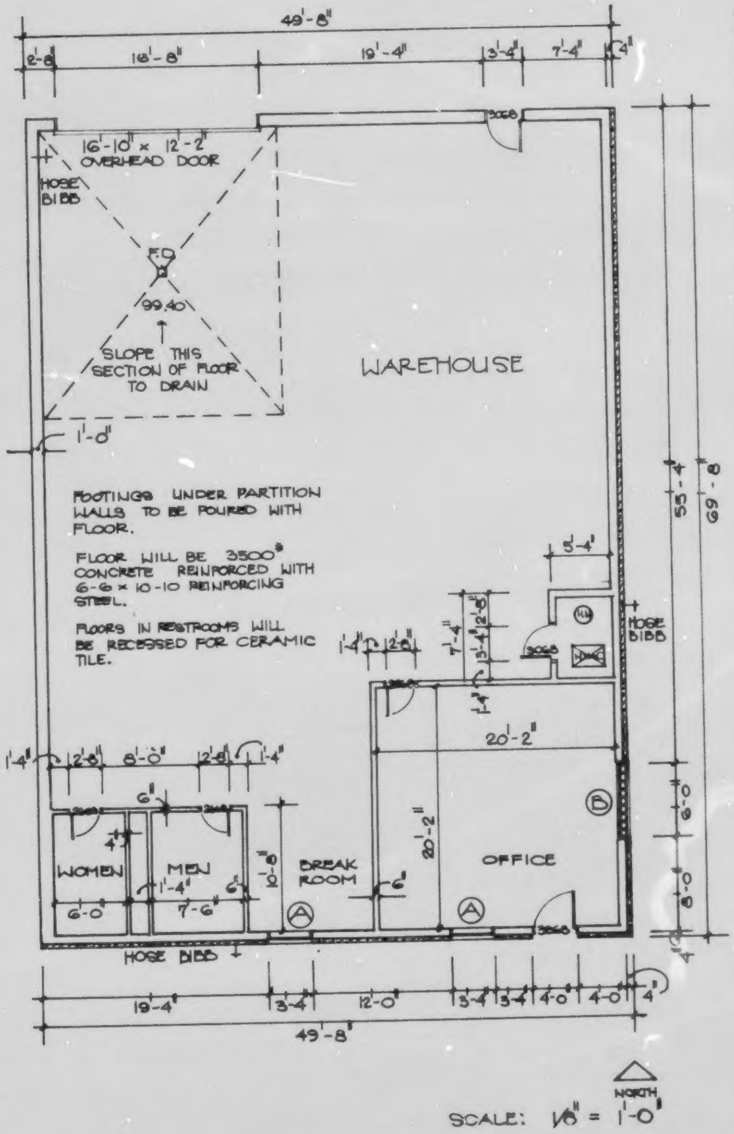
b. ______________________

TEST


12" GLAZED TILE COPING
METAL FLASHING
5 PLY BUILT-UP ROOF
RIGID INSULATION
CORRUGATED STEEL DECK
12 H4 BAR JOIST SET 3'-0" O.C. (NEED 23)
6" × 5" × 3/8" STEEL BEARING PLATE
12" CONCRETE BLOCK
1/2" × 4" IMPREGNATED EXPANSION
FINISH GRADE
4" CONCRETE 3500# W/6×6 - 10/10 REINFORCING STEEL
1" STYROFOAM PERIMETER INSULATION
1'-6"
3'-0"
1'-0"
4'-0"
SCALE: 1/2" = 1'-0"

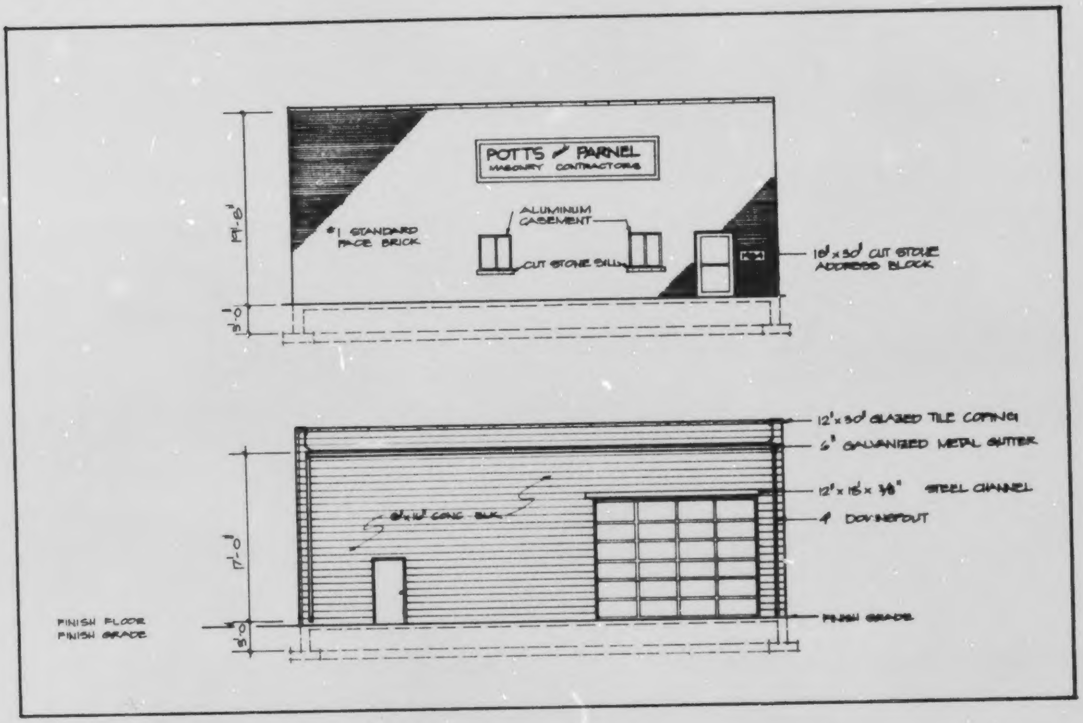
C. ______________________________

TEST


49'-8"
2'-8"
18'-8"
19'-4"
3'-4"
7'-4"
4"
16'-10" × 12'-2"
OVERHEAD DOOR
HOSE BIBB
F.D.
99.40
SLOPE THIS SECTION OF FLOOR TO DRAIN
WAREHOUSE
3068
1'-0"
FOOTINGS UNDER PARTITION WALLS TO BE POURED WITH FLOOR.
FLOOR WILL BE 3500# CONCRETE REINFORCED WITH 6-6 × 10-10 REINFORCING STEEL.
FLOORS IN RESTROOMS WILL BE RECESSED FOR CERAMIC TILE.
5'-4"
55'-4"
69'-8"
1'-4"
2'-8"
7'-4"
2'-8"
3'-4"
3068
HOSE BIBB
1'-4"
20'-2"
1'-4"
2'-8"
8'-0"
2'-8"
1'-4"
6"
4"
WOMEN
MEN
1'-4"
6"
6'-0"
7'-6"
10'-0"
BREAK ROOM
6"
20'-2"
OFFICE
Ⓐ
Ⓐ
Ⓑ
3068
6'-0"
8'-0"
4"
HOSE BIBB
19'-4"
3'-4"
12'-0"
3'-4"
3'-4"
4'-0"
4'-0"
4"
49'-8"
NORTH
SCALE: 1/8" = 1'-0"

d. ______________________________

TEST


19'-8"
3'-0
POTTS & PARNEL
MASONRY CONTRACTORS
#1 STANDARD FACE BRICK
ALUMINUM CASEMENT
CUT STONE SILL
16"x30" CUT STONE ADDRESS BLOCK
12"x30" GLAZED TILE COPING
6" GALVANIZED METAL GUTTER
12"x15"x 3/8" STEEL CHANNEL
4" DOWNSPOUT
8"x16" CONC BLK
17'-0"
3'-0
FINISH FLOOR
FINISH GRADE
FINISH GRADE

e. ______________________________

TEST

FINISH SCHEDULE

DOOR SCHEDULE

Symbol	Width	Height	Thickness	Material	Type	Quantity	Threshold	Remarks	Manufacturer
2668	2'-6"	6'-8"	1⅜"	Wood with vents	Slab core	3	None	Oil stain	
3068	3'-0"	6'-8"	1⅜"	Wood mahogany	Slab core	1	None	Oil stain	
3068	3'-0"	6'-8"	1¾"	Metal clad		1	Concrete	Pre finish	
3868	3'-8"	6'-8"	1¾"	Alum & glass	Ins. plate glass	1	Aluminum	None	
Over head	16'-10"	12'-2"				1	None	Oil stain	Clopay Model 900

WINDOW SCHEDULE

Symbol	Width	Height	Screen	Material	Type	Quantity	Remarks	Manufacturer	Catalog number
A	1'-8"	3'-8"	No	Aluminum	Casement	2-double			
B	6'-0"	4'-0"	No	Glass	Glass block	1		Stillburg plate glass	

LINTEL SCHEDULE

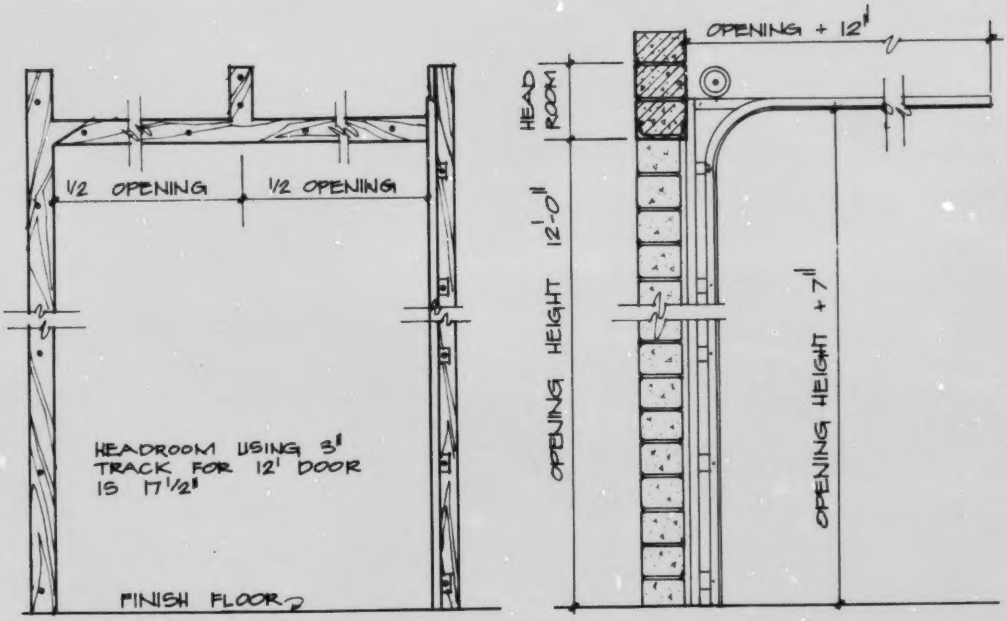
Steel	2	3½" x 3½" x ⅜" x 4'-0"
Steel	1 ea.	3½" x 3½" x ⅜" x 4'-8" 3½" x 7½" x ⅜" x 4'-0"
Steel	1 ea.	3½" x 3½" x ⅜" x 6'-8" 3½" x 7½" x ⅜" x 6'-8"
Concrete	3	6" x 8" x 4'-0"
Concrete	2	8" x 8" x 4'-8"
Concrete	1 ea.	6" x 8" x 4'-8" 12" x 8" x 4'-8"
Channel iron and rein. concrete	1	12" x 8" x 18'-0"

ROOM FINISHES

Rooms	Floors				Ceilings				Wall					Base			Trim		Remarks
	CERAMIC TILE	RUBBER TILE	CARPET	CONCRETE	ACOUSTIC TILE	WOOD	NONE		WOOD PANEL	WALL BOARD	WALL PAPER	PAINTED BLOCK	CERAMIC TILE	CERAMIC TILE	WOOD	RUBBER	WOOD	PLASTIC	
Office			✓		✓				✓						✓		✓		Owner will choose carpet walnut wainscot
Break Rm.		✓					✓			✓		✓				✓	✓		Use water-resistant finish
Womens Rm.	✓				✓								✓	✓			✓		
Mens Rm.	✓				✓								✓	✓			✓		
Furnace Rm.				✓			✓						✓						
Warehouse				✓			✓					✓							Use water-resistant finishes

f. ____________________

TEST


OPENING + 12"
HEAD ROOM
1/2 OPENING
1/2 OPENING
OPENING HEIGHT 12'-0"
OPENING HEIGHT + 7"
HEADROOM USING 3" TRACK FOR 12' DOOR IS 17 1/2"
FINISH FLOOR

OVERHEAD DOOR

SCALE: 3/8" = 1'-0"

g. ______________________

TEST

6. Distinguish among types of construction drawings according to their characteristics. Write a "P" in the blanks for plot plan, an "F" for foundation plan, an "FL" for floor plan, an "E" for elevations, an "S" for sections, a "D" for details, and an "SC" for schedules. Some blanks have more than one answer. Characteristics are continued on the following page.

_____a. Stairs and railings

_____b. Location of utilities

_____c. Wall partitions

_____d. Location and size of anchor bolts and reinforcing steel

_____e. Ornamental ironwork

_____f. Anchors and bonds

_____g. Roof lines

_____h. Types of construction through use of symbols

_____i. Wall thickness at various locations

_____j. Types of floor finishes

_____k. Windows

_____l. Room finishes

_____m. Location of existing conditions

_____n. Location of footings, grade beams, foundation walls, stem walls, piers, equipment footings, and foundations

_____o. Fixtures

_____p. Material types

_____q. Stairways

_____r. Built-ins

_____s. Outside walls, including the location and dimensions of all exterior openings

_____t. Finished and existing grade contours

_____u. Floor heights

_____v. Size of footings, grade beams, foundation walls, stem walls, piers, equipment footings, and foundations

_____w. Location of interior walls and partitions

_____x. Door frames

TEST

_____y. Location of structure on site

_____z. Appliances

_____aa. Location of equipment

_____bb. Doors (interior and exterior)

_____cc. Cutaway drawings such as stairs, walls, chimneys

_____dd. Other exterior dimensions

_____ee. Location and swing of doors

_____ff. Millwork, trim, and specialty items

_____gg. Grade lines

_____hh. Property lines

_____ii. Window and door types

_____jj. Paint

7. Describe divisions found in a set of building plans. List three items for each division.

a. Architectural

1. ______________________________

2. ______________________________

3. ______________________________

b. Structural

1. ______________________________

2. ______________________________

3. ______________________________

c. Mechanical and electrical

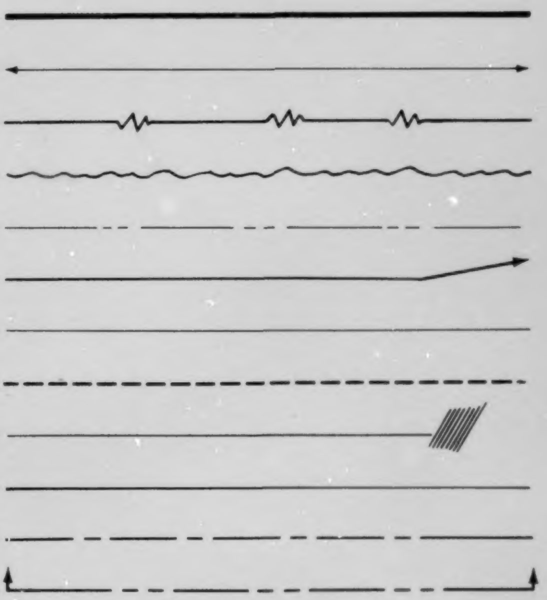
1. ______________________________

2. ______________________________

3. ______________________________

TEST

8. Label types of lines included in the alphabet of lines. Write the correct names in the blanks provided.



a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________

h. ______________________

i. ______________________

j. ______________________

k. ______________________

l. ______________________

9. Match types of lines to their correct descriptions. Write the correct numbers in the blanks. Types of lines and descriptions are continued on the following page.

_____a. Thin, unbroken lines that designate structure dimensions

_____b. Short dashes used to show lines that are not visible from that view

_____c. Lightly drawn lines used to draw the section lining in sectional drawings; different material symbol is used for each building material

_____d. Ruled lines with freehand breaks; used when an area cannot or should not be drawn entirely

_____e. Heavy lines that show main outline of the structure, including exterior walls, interior partitions, porches, patios, sidewalks, parking lots, and driveways

_____f. Thin lines used to outline the shape of equipment and furnishings

_____g. Wavy, uneven freehand lines; used when an area cannot or should not be drawn entirely

1. Fixture lines
2. Break lines, long
3. Object lines
4. Hidden lines
5. Break lines, short
6. Section lining
7. Dimension lines

TEST

_____h. Series of long and short dashes used to designate centers and provide a reference point for dimensioning

_____i. Lines that extend, but do not touch, the object lines; permit dimension lines to be drawn between them

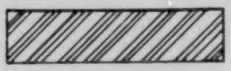
_____j. Broad lines drawn lightly with an arrow on the end; used to connect a note or dimension to a part of the structure

_____k. Heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning; shows the direction from which the section is supposed to be viewed

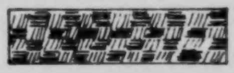
_____l. Thin lines consisting of a series of one long and two short dashes; used to indicate alternate positions of moving parts, adjacent positions of related parts, and for repeated details

8. Leaders
9. Phantom lines
10. Extension lines
11. Center lines
12. Section lines (cutting plane)

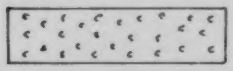
10. Label architectural symbols for floor plans and sectioning. Write the correct names in the blanks. Architectural symbols are continued on the following pages.



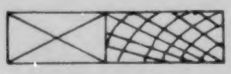
a. ______________________



b. ______________________

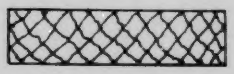


c. ______________________

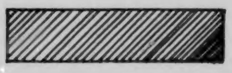


d. ______________________

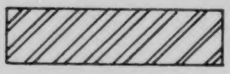
TEST



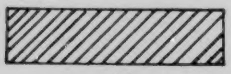
e. ______________________________



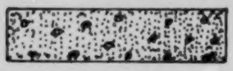
f. ______________________________



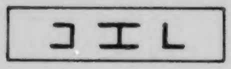
g. ______________________________



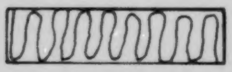
h. ______________________________



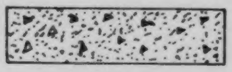
i. ______________________________



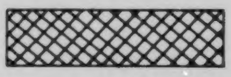
j. ______________________________



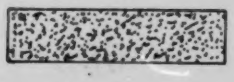
k. ______________________________



l. ______________________________

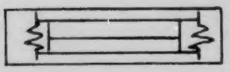


m. ______________________________

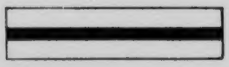


n. ______________________________

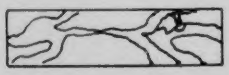
TEST



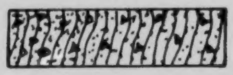
o. ____



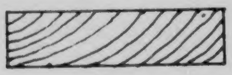
p. ____



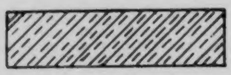
q. ____



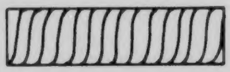
r. ____



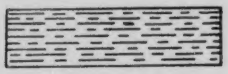
s. ____



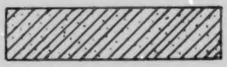
t. ____



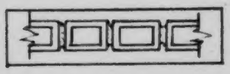
u. ____



v. ____

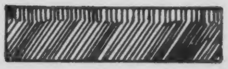


w. ____

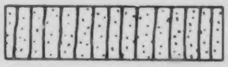


x. ____

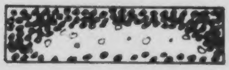
TEST



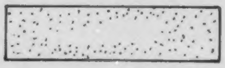
y. ______________________________



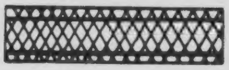
z. ______________________________



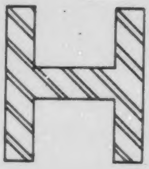
aa. ______________________________



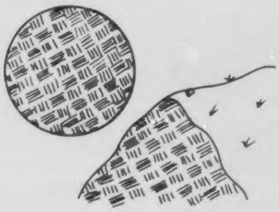
bb. ______________________________



cc. ______________________________

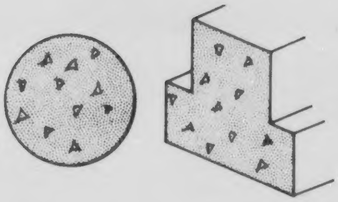


dd. ______________________________

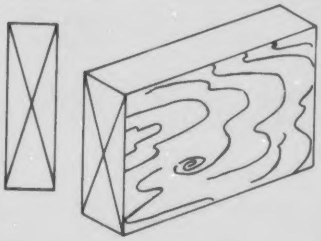


ee. ______________________________

TEST



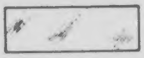
ff. ____________________



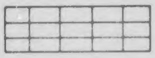
gg. ____________________

11. Label architectural symbols for elevations, exterior walls, and floor finishes. Write the correct names in the blanks.

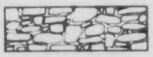
a. Elevations



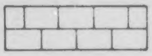
1) ____________________



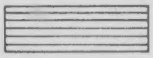
2) ____________________



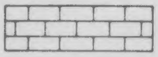
3) ____________________



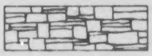
4) ____________________



5) ____________________



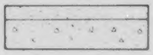
6) ____________________



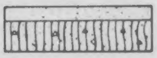
7) ____________________

TEST

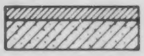
b. Exterior walls



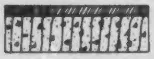
1) ______________________



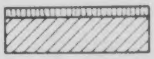
2) ______________________



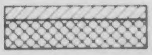
3) ______________________



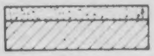
4) ______________________



5) ______________________

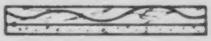


6) ______________________

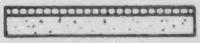


7) ______________________

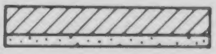
c. Floor finishes



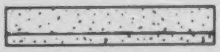
1) ______________________



2) ______________________



3) ______________________



4) ______________________

TEST

12. Match abbreviations commonly used on plans to their correct names. Write the correct numbers in the blanks.

_____a. Marble
_____b. Live load
_____c. Insulate
_____d. Cubic foot
_____e. Cinder block
_____f. Concrete block
_____g. Foundation
_____h. Facing tile
_____i. Cubic inch
_____j. Architectural
_____k. Weep hole
_____l. Structural
_____m. Partition
_____n. Material
_____o. Anchor bolt
_____p. Caulking
_____q. Fireplace
_____r. Linear
_____s. Cast stone
_____t. Terra-cotta
_____u. Bench mark
_____v. Firebrick
_____w. Limestone

1. CU IN
2. CONC B
3. ARCH
4. FDN
5. FT
6. CIN BL
7. LL
8. INS
9. CU FT
10. MR
11. MATL
12. CLKG
13. FP
14. WH
15. LIN
16. CS
17. STR
18. TC
19. AB
20. PTN
21. FBRK
22. LS
23. BM or ⊕

TEST

______x. Channel

______y. Standard

______z. Typical

______aa. Opening

______bb. Block

______cc. Center

______dd. Grade line

______ee. Joint

______ff. Modular

______gg. Waterproofing

______hh. Precast

______ii. On center

______jj. Scale

______kk. Brick

______ll. Flashing

______mm. Course

______nn. Center to center

______oo. Head

______pp. Bronze

______qq. Glass block

______rr. Cast concrete

______ss. Nominal

______tt. Specification

______uu. Manhole

______vv. Parallel

24. GL
25. GLBL
26. FL
27. JT
28. SPEC
29. OC
30. BRK
31. BRZ
32. BLK
33. OPNG
34. C
35. C CONC
36. NOM
37. TYP
38. C to C
39. STD
40. WP
41. HD
42. PRCST
43. MOD
44. MH
45. [
46. CTR
47. SC
48. PAR

TEST

______ww. Stone

______xx. Grade

______yy. Detail

______zz. Concrete

______aaa. Building line

______bbb. Angle

______ccc. Cubic yard

______ddd. Reinforce

______eee. Overall

______fff. Bearing

______ggg. Brick course

______hhh. Ceramic

______iii. Joist

______jjj. Dampproofing

______kkk. Fireproof

______lll. Column

______mmm. Elevation

______nnn. Center line

______ooo. Catch basin

______ppp. Not to scale

______qqq. Finish grade

______rrr. Masonry opening

______sss. Expansion joint

______ttt. Architectural terra-cotta

______uuu. Rough opening

49. EXP JT
50. CL or ℄
51. FG
52. ATC
53. DP
54. RO
55. NTS
56. COL
57. CB
58. FPRF
59. ∠
60. REINF
61. BRG
62. ELEV
63. CONC
64. OA
65. DET
66. CU YD
67. ST
68. BRK C
69. BL
70. JST
71. CER
72. GR
73. MO

TEST

13. State rules for reading an architect's scale.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

14. Select from the following list common scales to which plans are drawn. Write an "X" in the blank before each correct answer.

______a. 1 1/2" = 1' - 0"

______b. 1 1/16" = 1' - 0"

______c. 3/4" = 1' - 0"

______d. 1/8" = 1' - 0"

______e. 3 1/2" = 1' - 0"

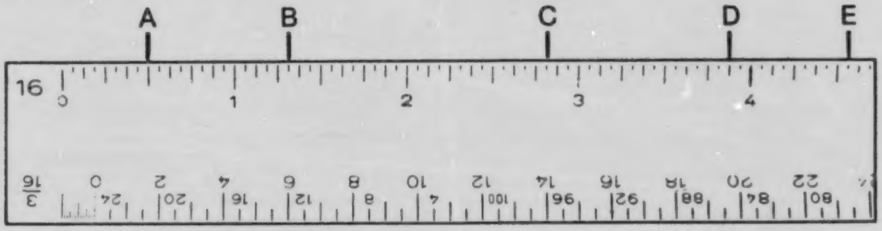
______f. 1/2" = 1' - 0"

______g. 1/4" = 1' - 0"

______h. 3" = 1' - 0"

15. Read the measurements on the architect's scales illustrated, using the scales given. Write the correct answers in the blanks.

a. Scale 12" = 1' - 0"



1) 0 to A = __________

2) 0 to B = __________

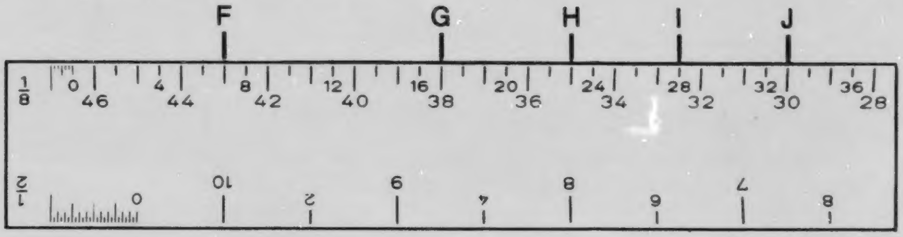
3) 0 to C = __________

4) 0 to D = __________

5) 0 to E = __________

TEST

b. Scale 1/8" = 1' - 0"


F
G
H
I
J
1/8
0 4 8 12 16 20 24 28 32 36
46 44 42 40 38 36 34 32 30 28
0 10 2 9 4 8 6 7 8
1/2

1) 0 to F = __________

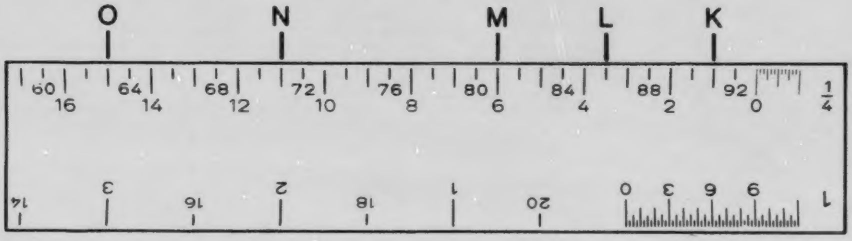
2) 0 to G = __________

3) 0 to H = __________

4) 0 to I = __________

5) 0 to J = __________

c. Scale 1/4" = 1' - 0"


O
N
M
L
K
60 64 68 72 76 80 84 88 92
16 14 12 10 8 6 4 2 0
1/4
14 3 16 2 18 1 20 0 3 6 9
1

1) 0 to K = __________

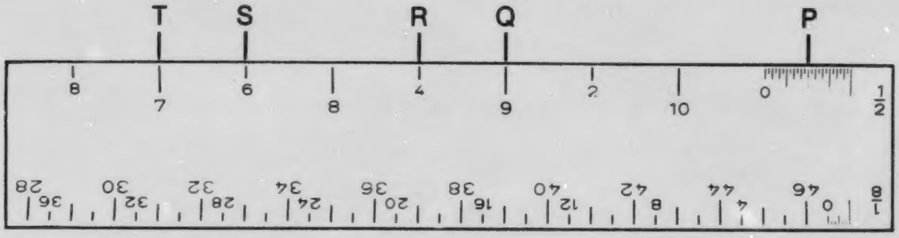
2) 0 to L = __________

3) 0 to M = __________

4) 0 to N = __________

5) 0 to O = __________

d. Scale 1/2" = 1' - 0"


T
S
R
Q
P
8 7 6 8 4 9 2 10 0
1/2
28 36 30 32 32 28 34 24 36 20 38 16 40 12 42 8 44 4 46 0
1/8

1) 0 to P = __________

2) 0 to Q = __________

3) 0 to R = __________

4) 0 to S = __________

4) 0 to T = __________

TEST

16. List four items found on structural drawings.

a. ______

b. ______

c. ______

d. ______

17. List fifteen items that may be covered in a set of masonry specifications.

a. ______

b. ______

c. ______

d. ______

e. ______

f. ______

g. ______

h. ______

i. ______

j. ______

k. ______

l. ______

m. ______

n. ______

o. ______

18. Name ten items that may be shown in detail on drawings.

a. ______

b. ______

c. ______

TEST

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

(NOTE: Test questions 19-23 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

19. Read an architectural plan.

20. Read a structural plan.

21. Read a floor plan.

22. Interpret a set of masonry specifications.

23. Interpret a finish schedule.

BASIC PLAN READING
UNIT III

ANSWERS TO TEST

1. Definition should include the following

   Architectural drawing, such as a floor plan, that shows a horizontal view of a structure; may be black on white or white on blue

2. Definition should include the following

   Set of detailed drawings prepared by an architect from which plans are reproduced, based on information from owner; contain all information and dimensions necessary to complete a job successfully

3. a. 6
   b. 2
   c. 3
   d. 1
   e. 5
   f. 4
   g. 9
   h. 10
   i. 12
   j. 11
   k. 8
   l. 7
   m. 20
   n. 18
   o. 16
   p. 14
   q. 19
   r. 13
   s. 17
   t. 15

4. a. Perspective
   b. Isometric
   c. Oblique
   d. Three view (orthographic projection)

5. a. Foundation plan
   b. Plot plan
   c. Section drawing
   d. Floor plan
   e. Elevation
   f. Schedules
   g. Detail

ANSWERS TO TEST

6. a. D
    b. P
    c. D
    d. F
    e. D
    f. S
    g. E
    h. FL
    i. S
    j. FL
    k. D, SC
    l. SC
    m. P
    n. F
    o. SC
    p. E
    q. FL
    r. D
    s. FL
    t. P
    u. E
    v. F
    w. FL
    x. D
    y. P
    z. SC
    aa. FL
    bb. D, SC
    cc. S
    dd. E
    ee. FL
    ff. D
    gg. E
    hh. P
    ii. E
    jj. SC

7. Description should include any three from each of the following divisions

    a. Architectural

        1. Site plan
        2. Floor plans
        3. Elevations

    b. Structural

        1. Framing
        2. Steelwork
        3. Roof construction
        4. Floor construction

    c. Mechanical and electrical

        1. Heating
        2. Air conditioning
        3. Water and sewage
        4. Electricity

ANSWERS TO TEST

8.	a.	Object line	g.	Extension line
	b.	Dimension line	h.	Hidden line
	c.	Break line, long	i.	Section lining
	d.	Break line, short	j.	Fixture line
	e.	Phantom line	k.	Center line
	f.	Leader	l.	Section line (cutting plane)

9.	a.	7	e.	3	i.	10
	b.	4	f.	1	j.	8
	c.	6	g.	5	k.	12
	d.	2	h.	11	l.	9

10.	a.	Aluminum	r.	Concrete block
	b.	Earth	s.	Wood (finish)
	c.	Cinders	t.	Brass or bronze
	d.	Wood (rough)	u.	Structural glass
	e.	Insulation (boards or quilts)	v.	State, bluestone, soapstone
	f.	Face brick	w.	Rubble
	g.	Steel or iron	x.	Glass block
	h.	Common brick	y.	Firebrick
	i.	Gravel with sand	z.	Cast stone
	j.	Structural steel	aa.	Gravel
	k.	Insulation (loose fill or batts)	bb.	Cut stone
	l.	Concrete	cc.	Structural clay tile (glazed)
	m.	Structural clay tile (unglazed)	dd.	Metal
	n.	Sand, plaster, cement	ee.	Earth
	o.	Plate or sheet glass	ff.	Concrete
	p.	Waterproofing	gg.	Rough lumber
	q.	Marble		

ANSWERS TO TEST

11. a. Elevations
    1) Glass
    2) Stack bond masonry
    3) Rubble
    4) Ashlar
    5) Brick
    6) Running bond masonry
    7) Squared stone

    b. Exterior walls
    1) Cut stone over concrete
    2) Cut stone over concrete block
    3) Face brick over rubble
    4) Face brick over concrete block
    5) Architectural terra-cotta over brick
    6) Brick over structural clay tile
    7) Cast stone over brick

    c. Floor finishes
    1) Marble on concrete
    2) Tile on concrete
    3) Brick on concrete
    4) Stone on concrete

ANSWERS TO TEST

12.	a.	10	t.	18	mm.	34	fff.	61
	b.	7	u.	23	nn.	38	ggg.	68
	c.	8	v.	21	oo.	41	hhh.	71
	d.	9	w.	22	pp.	31	iii.	70
	e.	6	x.	45	qq.	25	jjj.	53
	f.	2	y.	39	rr.	35	kkk.	58
	g.	4	z.	37	ss.	36	lll.	56
	h.	5	aa.	33	tt.	28	mmm.	62
	i.	1	bb.	32	uu.	44	nnn.	50
	j.	3	cc.	46	vv.	48	ooo.	57
	k.	14	dd.	24	ww.	67	ppp.	55
	l.	17	ee.	27	xx.	72	qqq.	51
	m.	20	ff.	43	yy.	65	rrr.	73
	n.	11	gg.	40	zz.	63	sss.	49
	o.	19	hh.	42	aaa.	69	ttt.	52
	p.	12	ii.	29	bbb.	59	uuu.	54
	q.	13	jj.	47	ccc.	66		
	r.	15	kk.	30	ddd.	60		
	s.	16	ll.	26	eee.	64		

13. a. Do not use scale if dimensions are available
    b. Be sure that scale is lying flat on surface being measured
    c. Select proper scale ratio
    d. Measure from center of one line to center of next line
    e. Read in order feet, inches, and fractions of inches
    f. Double-check all measurements

ANSWERS TO TEST

14. a, d, f, g, h

15. a. 1) 1/2″
    2) 1 5/16″
    3) 2 13/16″
    4) 3 7/8″
    5) 4 9/16″

    b. 1) 7′ - 0″
    2) 17′ - 0″
    3) 23′ - 0″
    4) 28″ - 0″
    5) 33′ - 0″

    c. 1) 1′ - 0″
    2) 3′ - 6″
    3) 6′ - 0″
    4) 11′ - 0″
    5) 15′ - 0″

    d. 1) 6″
    2) 3′ - 0″
    3) 4′ - 0″
    4) 6′ - 0″
    5) 7′ - 0″

16. Answer should include any four of the following

    a. Heights of finished floors and walls

    b. Height and bearing of bar joist or steel joist

    c. Locations of bearing steel

    d. Height of steel beams, concrete planks, concrete Ts, and poured-in-place concrete

    e. Bearing plate locations

    f. Reinforcing steel and schedules showing size and spacing

    g. Anchor bolt locations, size of bolts, and spacing

    h. Solid masonry units, or block filled solid with mortar and reinforced with steel

    i. Stairs

    j. Schedules

ANSWERS TO TEST

17. Answer should include any fifteen of the following

    a. General

        1) Description
        2) Codes and standards
        3) Submittals
        4) Product handling and storage
        5) Quality assurance
        6) References
        7) Prism testing
        8) Unit strength method testing
        9) Sample panels
        10) Mortar test

    b. Products

        1) General
        2) Mortar
        3) Structural grout
        4) Brick
        5) Concrete masonry units
        6) Precast concrete lintels
        7) Setting material for base and bearing plates
        8) Reinforcement and anchorages
        9) Through wall flashing
        10) Insulation materials
        11) Specialty masonry accessories
        12) Mortar-coloring agent

ANSWERS TO TEST

13) Control joint resilient keys

14) Expansion joint materials

15) Rope wick

c. Execution

1) Surface conditions

2) Coordination

3) Placing tolerances

4) Mixing mortar

5) Installation — general

6) Time requirements for placing load-bearing masonry

7) Laying concrete masonry units

8) Laying brick units

9) Placing reinforcement and metal ties in concrete masonry

10) Placing reinforcement and metal ties in brick masonry

11) Installing control joints

12) Installing expansion joints

13) Filling bond beams and lintels

14) Filling piers, pilasters, and grouted wall construction cavities

15) Setting base and bearing plates

16) Pilasters

17) Flashing installation

18) Installation of insulation

19) Backplastering

20) Parging

21) Installing items furnished by other trades

ANSWERS TO TEST

22) Built-in items furnished and installed by other trades
23) Construction of weep holes
24) Protection during construction
25) Cold weather construction
26) Pointing and caulking
27) Cleaning

18. Answer should include any ten of the following

a. Footings, foundations, sills, and walls
b. Anchor bolts
c. Beams, floor joist, and bridging
d. Sills, floor framing, exterior walls, and vapor barriers
e. Weep holes
f. Floor height, thickness, expansion, and reinforcing
g. Interior walls and partitions
h. Metal ties, anchors and backup
i. Windows and doors
j. Beam and joist bearing
k. Roof, cornice, soffit, and ceilings
l. Gravel stops, fascia, flashing
m. Fireplaces
n. Stairwells and stair assembly
o. Insulation
p. Flashing and waterproofing
q. Caulking and weatherproofing
r. Control joint location

ANSWERS TO TEST

19. Evaluated to the satisfaction of the instructor

20. Evaluated to the satisfaction of the instructor

21. Evaluated to the satisfaction of the instructor

22. Evaluated to the satisfaction of the instructor

23. Evaluated to the satisfaction of the instructor

ESTIMATING
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to calculate problems dealing with estimating and should be able to estimate materials for various types of jobs. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with estimating to their correct definitions.
2. Calculate areas of square or rectangular surfaces.
3. Calculate basic problems dealing with estimating.
4. List rule of thumb guidelines used by the bricklayer when estimating materials.
5. Estimate material for a specific brick job.
6. Estimate material for a specific block job.
7. Use a set of plans to take off and estimate all masonry materials.

ESTIMATING
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Obtain transparencies.

      (NOTE: Transparencies are available from AGC and CIMC.)

   B. Provide students with objective sheet.

   C. Discuss unit and specific objectives.

   D. Provide students with information and assignment sheets.

   E. Discuss information and assignment sheets.

   F. Give test.

   G. Complete appropriate section of competency profiles.

      (NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Transparency masters

      1. TM #1 — Area

      2. TM #2 — Decimals of Fractional Inches to One Foot

      3. TM #3 — Ratio and Proportion

   E. Assignment sheets

      1. Assignment Sheet #1 — Estimate Material for a Specific Brick Job

      2. Assignment Sheet #2 — Estimate Material for a Specific Block Job

      3. Assignment Sheet #3 — Use a Set of Plans to Take Off and Estimate All Masonry Materials

   F. Answers to assignment sheets

   G. Test

   H. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

- A. Kreh, R. T., Sr. *Masonry Skills*. Albany, New York: Delmar Publishers, Inc., 1982.
- B. Turcotte, Raymond J. *Bricklaying Curriculum*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1977.

ESTIMATING
UNIT IV

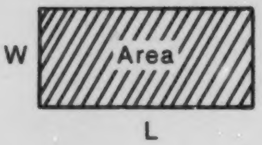
INFORMATION SHEET

I. Terms and definitions

A. Area — Measure of a flat surface; expressed in square units (Figure 1)

EXAMPLE: W × L = Area in square units

FIGURE 1



B. Calculate — To solve by mathematical process

C. Cubic unit — Unit with three dimensions including length, width, and height

D. Estimating — Determining amount of material needed to complete a specific job

E. Formula — Group of symbols expressing a single concept or mathematical fact

F. Linear — Relating to a straight line or length

G. Modular — Based on a nominal 4-inch spacing

H. Nominal size — Theoretical size that may vary from the actual size

EXAMPLE: Size of brick and mortar joint

I. Proportion — To adjust in size relative to other parts or things (Transparency #3)

EXAMPLE: 1:1:3 = 2:2:6

J. Ratio — Relationship in quantity, amount, or size between two or more things; expressed with ratio symbol (Transparency #3)

EXAMPLE: One part cement to one part lime to three parts sand = 1:1:3

K. Rubblestone — Rough, irregular-shaped stone

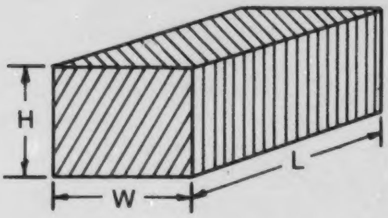
INFORMATION SHEET

L. Surface — Exterior or upper boundary of an object or body

M. Volume — Space occupied by a body; expressed in cubic units (Figure 2)

EXAMPLE: L × H × W = Volume in cubic units

FIGURE 2



II. Calculating areas of square or rectangular surfaces (Transparency #1)

A. Determine length and width

B. Convert length and width to similar units of measure

C. Use the formula Length × Width = Area (L × W = A)

EXAMPLES:

1) Area of an object 0′-10″ long and 0′-4″ wide
L × W = A
10″ × 4″ = 40 sq in

2) Area of a wall 25′-0″ long and 15′-0″ high
L × W = A
25′ × 15′ = 375 sq ft

3) Area of a wall 12′-6″ by 12′-6″
12′-6″ = 12.5′
L × W = A
12.5 × 12.5 = 156.25 or 156 1/4 sq ft

III. Calculating basic problems dealing with estimating (Assignment Sheets #1-#3)

(NOTE: Use decimals instead of fractions when estimating materials. See Transparency #2.)

A. Estimate area of masonry units required

1. Calculate area in square feet of each surface to be constructed

INFORMATION SHEET

2. Determine total area to be constructed by adding areas of surfaces to be constructed

3. Calculate area in square feet of each opening in surfaces to be constructed

4. Determine total area of openings by adding areas of openings

5. Subtract total area of openings from total area to be constructed to determine area of masonry units required

6. Determine total area of masonry units to include breakage and waste

    a. Multiply area of masonry units by a percentage to cover breakage and waste

    b. Add breakage and waste allowance to area of masonry units required

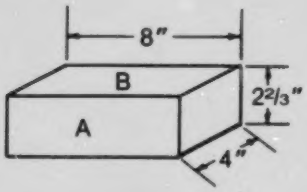
B. Estimate number of masonry units or amount of stone required, or use tables to determine number of masonry units required

1. Calculating number of masonry units required (Figures 3-5)

    a. Determine area of masonry unit face to be used on constructed surface

    EXAMPLE: Standard brick

FIGURE 3

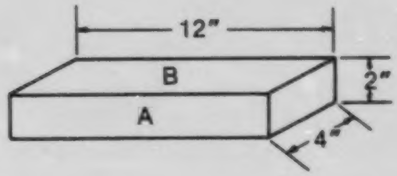


Area A = 8" × 2.67" = 21.36 sq in
Area B = 8" × 4" = 32 sq in

INFORMATION SHEET

EXAMPLE: Roman brick

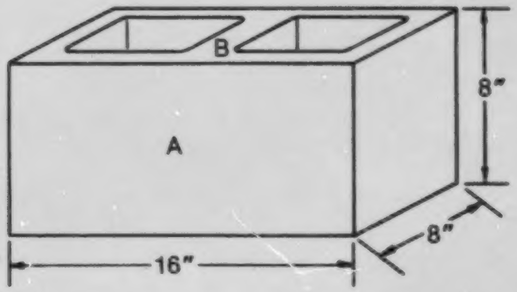
FIGURE 4



Area A = 12" × 2" = 24 sq in
Area B = 12" × 4" = 48 sq in

EXAMPLE: Stretcher block

FIGURE 5



Area A or B= 16" × 8" = 128 sq in

b. Determine number of masonry units per square foot by dividing 144 square inches by the area of the face to be used

(NOTE: There are 144 square inches in a square foot.)

c. Multiply total area of masonry units required by the number of masonry units per square foot

(NOTE: The number of masonry units per square foot is called a *conversion factor*. A conversion factor is always the same for a particular size face of masonry unit.)

INFORMATION SHEET

d. Round off to the nearest whole unit

EXAMPLE: Calculate number of standard bricks required to construct a wall 25′ - 0″ long and 8′ - 0″ high, with a window 2′ - 6″ × 4′ - 0″.

Area to be constructed = 25′ - 0″ × 8′ - 0″ = 200 sq ft.

Area of opening 2′ - 6″ × 4′ - 0″ = 10 sq ft

Area of masonry units = 200 sq ft − 10 sq ft = 190 sq ft

Amount for breakage and waste = 190 sq ft × 0.25 = 47.5 sq ft

Total area of masonry units = 190 sq ft + 48 sq ft = 238 sq ft

Area of masonry unit face = 2.67″ × 8″ = 21.36 sq in

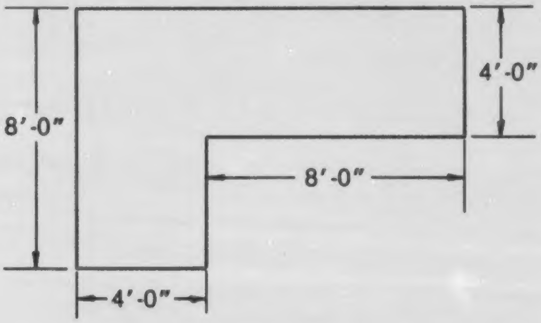
Number of masonry units per square foot = 144 sq in ÷ 21.36 sq in = 6.74 bricks per sq ft

Number of masonry units required = 238 sq ft × 6.74 bricks per sq ft = 1,604 bricks

INFORMATION SHEET

EXAMPLE: Calculate number of Roman bricks for the L-shaped walk shown (Figure 6).

FIGURE 6



Area to be constructed = (8' - 0" × 4' - 0") + (8' - 0" × 4' - 0") = 32 sq ft + 32 sq ft = 64 sq ft

Amount for breakage and waste = 64 sq ft × 0.25 = 16 sq ft

Total area of masonry units = 64 sq ft + 16 sq ft = 80 sq ft

Area of masonry unit face = 4" × 12" = 48 sq in

Number of masonry units per square foot = 144 sq in ÷ 48 sq in = 3 bricks

Number of masonry units required = 80 sq ft × 3 bricks per square foot = 240 bricks

2. Calculating amount of stone required

   a. Determine thickness of stone to be used

   b. Determine average square foot coverage per ton of stone at the required thickness

      (NOTE: The area of coverage will vary greatly according to the type, quality, and cleanliness of the stone. A ton of average stone 1 to 5 inches thick will cover from 30 to 45 square feet.)

   c. Divide total area to be constructed by coverage per ton

      EXAMPLE: Estimate the number of tons of stone required for a wall 50' - 0" long × 8' - 0" high × 0' - 5" thick if the stone used is quarried rough limestone averaging 30 square feet coverage per ton at 5" of thickness.

      Area of stone required = 50'-0" × 8'-0" = 400 sq ft

      Number of tons of stone = 400 sq ft ÷ 30 sq ft per ton of stone = 13.33 or $13\frac{1}{3}$ tons of stone

INFORMATION SHEET

3. Using tables to determine number of masonry units required

   a. Determine size of masonry units to be used

   b. Refer to table to determine conversion factor

   c. Multiply total area of masonry units required by conversion factor provided in table

      (NOTE: Conversion factors in tables may be based on number of masonry units per square foot, per 100 square feet, or by some other measurements. Be sure to adjust the area used in multiplying so that you use the same measurement used in the table.)

EXAMPLE: Use Table 1 to determine number of $7\frac{5}{8}'' \times 7\frac{5}{8}'' \times 15\frac{5}{8}''$ blocks required for an 8-inch thick wall 25′- 0″ long × 8′ - 0″ high.

TABLE 1

BLOCK WALLS IN RUNNING BOND
(Full Bed and Head Joints)

	For 100 Square Feet of Wall		
Actual Unit Size (Width × Height × Length) in Inches	Nominal Wall Thickness (Inches)	Number of Units	Mortar (Cubic Feet)
$3\frac{5}{8} \times 3\frac{5}{8} \times 15\frac{5}{8}$	4	225.0	4.3
$5\frac{5}{8} \times 3\frac{5}{8} \times 15\frac{5}{8}$	6	225.0	4.3
$7\frac{5}{8} \times 3\frac{5}{8} \times 15\frac{5}{8}$	8	225.0	4.3
$3\frac{3}{4} \times 5 \times 11\frac{3}{4}$	4	221.0	3.7
$5\frac{3}{4} \times 5 \times 11\frac{3}{4}$	6	221.0	3.7
$7\frac{3}{4} \times 5 \times 11\frac{3}{4}$	8	221.0	3.7
$3\frac{5}{8} \times 7\frac{5}{8} \times 15\frac{5}{8}$	4	112.5	2.6
$5\frac{5}{8} \times 7\frac{5}{8} \times 15\frac{5}{8}$	6	112.5	2.6
$7\frac{5}{8} \times 7\frac{5}{8} \times 15\frac{5}{8}$	8	112.5	2.6
$11\frac{5}{8} \times 7\frac{5}{8} \times 15\frac{5}{8}$	12	112.5	2.6

Table based on $\frac{3}{8}$-inch mortar joints; 10 percent allowance for waste

(NOTE: Thickness of block is not figured in estimating number of units required for a job.)

Area to be constructed = 25′- 0″ × 8′ - 0″ = 200 sq ft

Conversion factor = 112.5 blocks ($7\frac{5}{8}'' \times 7\frac{5}{8}'' \times 15\frac{5}{8}''$) per 100 square feet of 8-inch wall

Number of masonry units required = 2 × 112.5 = 225 blocks

(NOTE: Two was used as the multiplier because the table gives the number of blocks per 100 square feet.)

INFORMATION SHEET

EXAMPLE: Use Table 2 to determine the number of 4" × 2⅔" × 8" bricks needed to construct a facing wall 4'-6" high × 130'-0" long.

TABLE 2

FOUR- AND SIX-INCH BRICK FACING WALLS IN RUNNING BOND

(Full Bed and Head Joints)

Nominal Size of Brick (Inches)	Number of Bricks per Sq Ft of Wall	Cu Ft of Mortar per Sq Ft of Wall*		Cu Ft of Mortar per 1,000 Bricks*	
		⅜" joint	½" joint	⅜" joint	½" joint
4 × 2⅔ × 8	6.750	0.0608	0.0765	8.90	11.30
4 × 2 × 12	6.000	0.0676	0.0900	11.30	15.00
4 × 2⅔ × 12	4.500	0.0535	0.0710	11.90	15.80
4 × 3⅕ × 8	5.625	0.0517	0.0670	9.36	11.92
4 × 4 × 8	4.500	0.0432	0.0575	9.60	12.80
4 × 4 × 12	3.000	0.0300	0.0520	13.00	17.30
SCR brick**	4.500	–	0.1550	–	34.25

*10 percent added for waste **Designed for ½" joint only

Area to be constructed = 4'-6" × 130'-0" = 585 sq ft

Conversion factor = 6.75 bricks (4" × 2⅔" × 8") per square foot of wall

Number of masonry units = 6.75 × 585 sq ft = 3,948.75 bricks or 3,949 bricks

(NOTE: Table 2 also provides conversion factors for mortar. Tables are available for estimating other materials besides masonry units, such as mortar and quantities of materials used in mixing mortars.)

INFORMATION SHEET

C. Estimate amounts of cement, lime, and sand needed using tables

1. Determine cubic feet of mortar needed
2. Determine type of mortar to be used
3. Refer to table to determine amounts of cement, lime, and sand per cubic foot
4. Multiply amounts of cement, lime, and sand by cubic feet of mortar needed

EXAMPLE: Use Table 3 to determine amounts of cement, lime, and sand needed for 34.41 cubic feet of type M mortar.

TABLE 3

QUANTITIES OF CEMENT, LIME, AND SAND REQUIRED PER CUBIC FOOT OF MORTAR (By Volume)

Mortar Type	Portland Cement (Cu Ft)	Hydrated Lime (Cu Ft)	Sand (Cu Ft)
M (A-1)	0.300	0.075	0.925
S (A-2)	0.220	0.110	0.990
N (B)	0.163	0.163	0.978
O (C)	0.110	0.220	0.990
K (D)	0.065	0.260	0.975

0.300 × 34.41 cu ft mortar needed = 10.32 cu ft cement
0.075 × 34.41 cu ft mortar needed = 2.58 cu ft lime
0.925 × 34.41 cu ft mortar needed = 31.83 cu ft sand

IV. Rule of thumb guidelines used by the bricklayer when estimating materials

A. Length × height − openings = square feet of area to cover

B. Square feet × 1.125 = number of blocks in a wall

C. Square feet × 1.2 = number of blocks including waste

D. Height of wall ÷ 0.67 ($^2/_3$) = number of block courses high

E. Length of wall × 0.75 ($^3/_4$) = number of blocks in length

F. Blocks in length × courses high = number of blocks needed

INFORMATION SHEET

G. A bricklayer can lay 30 blocks per bag of masonry cement; divide number of blocks by 30 to find how much masonry cement to order

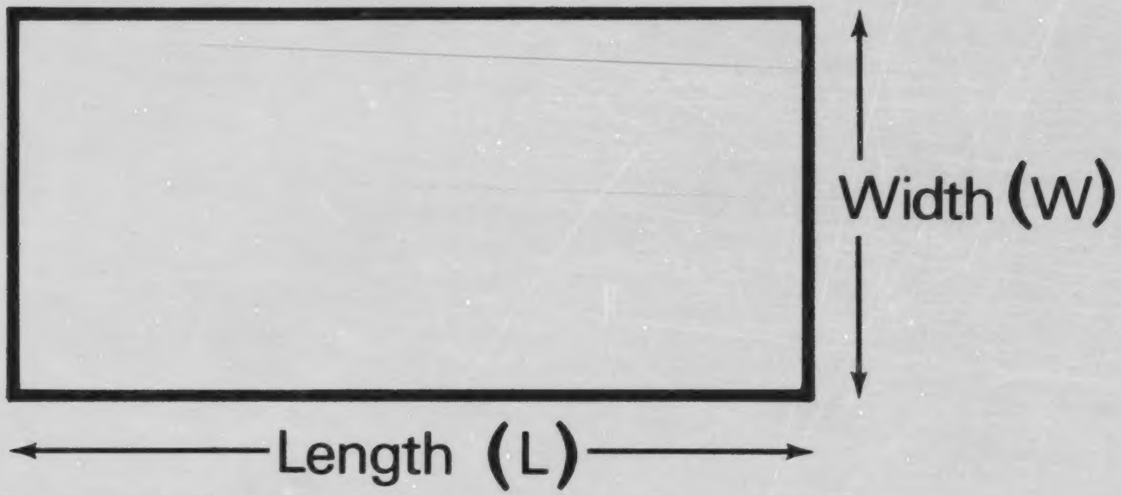
H. Every eight bags of masonry cement requires 1 ton of sand

I. It takes 1 ton of sand to lay 1,000 bricks

J. It takes eight bags of masonry cement to lay 1,000 bricks

Area

SQUARE or RECTANGLE


Width (W)
Length (L)

Length X Width = Area

Decimals of Fractional Inches to One Foot

Inch	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″
0	.0000	.0833	.1677	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219
1/8	.0104	.0937	.1771	.2604	.3437	.4271	.5104	.5937	.6771	.7604	.8437	.9271
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427
3/8	.0312	.1146	.1979	.2812	.3646	.4479	.5312	.6146	.6979	.7812	.8646	.9479
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
9/16	.0469	.1302	.2135	.2969	.3802	.4635	.5469	.6302	.7135	.7969	.8802	.9635
5/8	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
13/16	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844
7/8	.0729	.1562	.2396	.3229	.4062	.4896	.5729	.6562	.7396	.8229	.9062	.9896
15/16	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948

Ratio and Proportion

1:1:6 = ratio of cement, lime, and sand in mortar mixture

.5:.5:3.0 = same proportion of materials (1:1:6 cut in half)

ESTIMATING
UNIT IV

ASSIGNMENT SHEET #1 — ESTIMATE MATERIALS FOR A SPECIFIC BRICK JOB

NAME ______________________________ SCORE ______________

The competent bricklayer knows how to estimate materials quickly and accurately for a specific brick job. Accurate estimation is cost effective and eliminates needless waste of materials and time.

Find number of bricks needed for walls of a building. Show all work. Write answers in the blanks.

Side one — 10′ - 0″ × 24′ - 0″ with one door 3′ - 4″ × 6′ - 8″ and two windows 2′ - 6″ × 4′ - 0″

Side two — 10′ - 0″ × 18′ - 0″ with four windows 2′ - 0″ × 2′ - 4″

Side three — 10′ - 0″ × 24′ - 0″ with two doors 3′ - 4″ × 6′ - 8″

Side four — 10′ - 0″ × 18′ - 0″ with no openings

A. Estimate number of bricks needed using $2\frac{2}{3}$″ × 4″ × 8″ nominal brick, requiring 6.75 bricks per square foot of surface, and allowing 0.25 for waste and breakage.

Bricks = ______________________

ASSIGNMENT SHEET #1

B. Write number of bricks to order.

Bricks = ______________________________

C. Estimate number of bags of cement if it takes six bags of masonry cement per 1,000 bricks.

Cement = ______________________________

D. Estimate amount of sand to order if it takes one ton of sand for every eight bags of cement.

Sand = ______________________________

ESTIMATING
UNIT IV

ASSIGNMENT SHEET #2 — ESTIMATE MATERIAL FOR A SPECIFIC BLOCK JOB

NAME ______________________________ SCORE ______________

The competent bricklayer knows how to estimate materials quickly and accurately for a specific block job. Accurate estimation is cost effective and eliminates needless waste of materials and time.

Find number of blocks needed for four walls of a building. Show all work. Write answers in the blanks.

Side one — 12′ - 0″ × 28′ - 0″ with one door 3′ - 4″ × 6′ - 8″ and two windows 2′ - 6″ × 4′ - 0″

Side two — 12′ - 0″ × 20′ - 0″ with no openings

Side three — 12′ - 0″ × 28′ - 0″ with three windows 1′ - 11″ × 2′ - 0″

Side four — 12′ - 0″ × 20′ - 0″ with one door 10′ - 0″ × 8′ - 0″

A. Estimate number of blocks needed using 8″ × 8″ × 16″ nominal block, requiring 1.125 blocks per square foot of surface.

Blocks = ______________________

ASSIGNMENT SHEET #2

B. Write number of blocks to order.

Blocks = ______________________

C. Estimate number of bags of cement to order if it takes one bag of masonry cement per 45 units of block.

Cement = ______________________

D. Estimate amount of sand to order if it takes 1 ton of sand for every eight bags of masonry cement.

Sand = ______________________

ESTIMATING
UNIT IV

ASSIGNMENT SHEET #3 — USE A SET OF PLANS TO TAKE OFF AND ESTIMATE ALL MASONRY MATERIALS

NAME ______________________________ SCORE ______________

It is essential that the bricklayer know how to read job plans and take off and estimate all materials pertaining to the masonry contractor.

Study the Sample Quantity Estimate on the following page, then use the set of plans that follows to complete the Quantity Estimate form.

ASSIGNMENT SHEET #3

SAMPLE QUANTITY ESTIMATE

PROJECT *Underwood Creek Pump Station* ESTIMATE NO.

LOCATION *FACE BRK. - STD SIZE - No colored mortar* SHEET NO. *1 of 3*

NAME SCORE DATE *1-20-82*

DESCRIPTION	DIMENSIONS LENGTH	HEIGHT	QUANT.	UNIT PRICE	TOTAL EST. MATERIAL COST	UNIT PRICE	TOTAL EST. LABOR COST	TOTAL
Exterior	75%	34.15 (	M = 20.80	+ 3/4L	= 13.35 = 34.15)			
04252								
Face Brick	600/		14,830	Pcs .298	4419 -	.455	6748 -	11167 -
Wash F.B.			2197	S.F. .22	483 -	—	SUB	483 -
04230								
12 STD. WT. SOS.	22/		481 Pcs.	.84	404 -	1.55	746 -	1150 -
8 " " BR. Up.	24/		2915 Pcs	.71	2070 -	1.42	4139 -	6209 -
8 " " 1/2 CRS	24/		68 Pcs	.71	48 -	1.42	97 -	145 -
6 STD. WT. @ BM.	18/		24 Pcs	.64	15 -	1.90	46 -	61 -
4 " " SOS	25/		687 PCS	.57	392 -	1.37	941 -	1333 -
4 " " @ Lintel	18/		8 Pcs	.57	5 -	1.90	15 -	20 -
ADD for 8x16 Bond Beam			135 Pcs.	.15	20 -	—	—	20 -
Grout Fill " "	12/		46 CF.	1.65	76 -	2.85	131 -	207 -
#5 Rebar " "			200 LF	—	—	.10	20 -	20 -
D.O.W. Rapid C.J.			46 VLF	2.00	92 -	1.00	46 -	138 -
Set Brg. PLS	12/		28 Pcs	—	—	2.85	80 -	80 -
Set A.B.	15/		396 Pcs	—	—	2.28	903 -	903 -
Grout Fill BLK. Random	14/		162 CF	1.65	267 -	2.44	395 -	662 -
#5 Rebar			80 VLF	—	—	.10	8 -	8 -
#4 Rebar			880 VLF	—	—	.10	88 -	88 -
12 D.O.W. LAD #9 Galv			2500 V.F.	.09	225 -	—	—	225 -
					8516 -		14403 -	22919 -
		431 #2			731 -		318 -	1046 -
NO: Rebar MTL.		74 #3			898 -		2596 -	3494 -
Winter enclosures		505 MH			10145 -		17317 -	27462 - ✓
Conc. preparation							Tax	405
	✓	C.G. Schmidt		Guenther NB				
	✓	Korndorfer		Nelson NB		4.8 hr. @	22.80 Supt.	1094 -
Includes: Flash'g	NB	North Shore		O'Brian & Brauer ✓		8%	MISC.	609 -
Cavity Insl.	✓	Ziegler	1-312-546-8215			10%	OVH & P	3104 -
ADDM #1 & 2		Keno & Sons	1-312-432-7150					32674 -
Sales Tax ($400.00)	NB	Camosy	1-933-4752		Stevens NB		Bid $	32500.00

BLC - 399-B

ASSIGNMENT SHEET #3

QUANTITY ESTIMATE

PROJECT Masonry Shop ESTIMATE NO.

LOCATION 1982 4th Street SHEET NO. 1 of 2

NAME SCORE DATE

	DIMENSIONS							
DESCRIPTION	LENGTH	HEIGHT	QUANT.	UNIT PRICE	TOTAL EST. MATERIAL COST	UNIT PRICE	TOTAL EST. LABOR COST	TOTAL
Exterior								
12" concrete block								
4" ½ partition block								
4" x 4" x 8" concrete plugs								
8" concrete block								
Glass block								
Standard brick								
Limestone sills								
4" x 5½" x 5'-11⅝"								
4" x 5½" x 3'-3⅝"								
Lintels								
12" x ⅜" x 18' steel channel								
3½" x 3½" x ⅜" x 4'-0" ∠								
3½" x 3½" x ⅜" x 4'-8" ∠								
3½" x 7½" x ⅜" x 4'-8" ∠								
3½" x 3½" x ⅜" x 6'-8" ∠								
3½" x 7½" x ⅜" x 6'-8" ∠								
6" x 8" x 4'-0" concrete								
8" x 8" x 4'-8" concrete								
6" x 8" x 4'-8" concrete								
12" x 8" x 4'-8" concrete								
Terra Cotta Coping								
Address block								
Mason Cement (Bags)								
Sand (Tons)								
Anchor Reinforcing bars								
Wall ties								
Anchors or Reinforcing	Furnished							

ASSIGNMENT SHEET #3

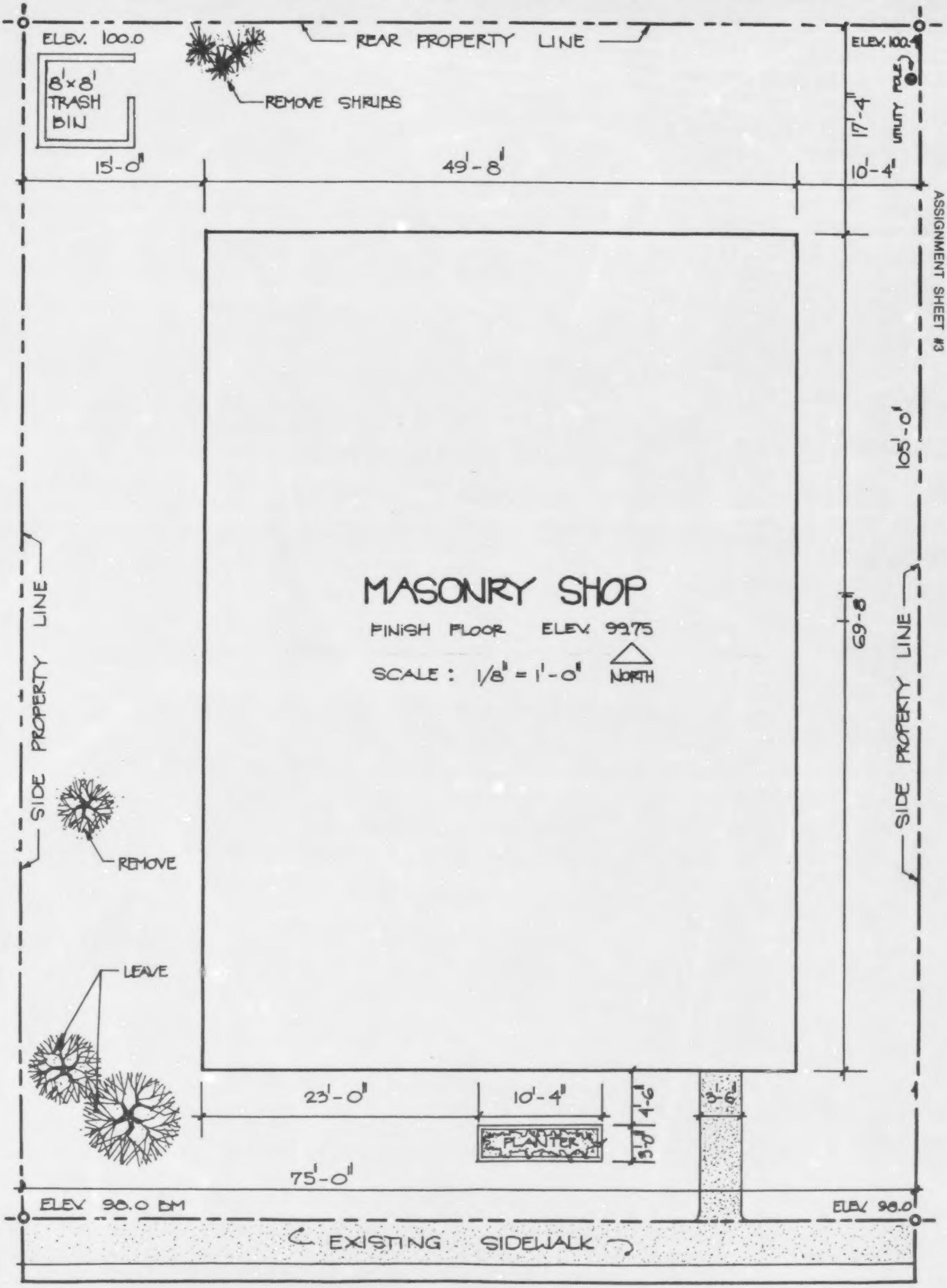
QUANTITY ESTIMATE

PROJECT Masonry Shop ESTIMATE NO.

LOCATION 1982 4th Street SHEET NO. 2 of 2

NAME SCORE DATE

	DIMENSIONS							
DESCRIPTION	LENGTH	HEIGHT	QUANT.	UNIT PRICE	TOTAL EST. MATERIAL COST	UNIT PRICE	TOTAL EST. LABOR COST	TOTAL
Interior								
6" concrete block								
6" 1/2 block								
6" L-Corners								
4" Partition block								
4" 1/2 partition block								
Bearing plates								
Trash Bin								
8" concrete block								
8" 1/2 block								
Planter								
Standard brick								
Weephole material								
Limestone coping								


ELEV. 100.0
8'×8' TRASH BIN
REMOVE SHRUBS
REAR PROPERTY LINE
ELEV. 100.4
UTILITY POLE
17'-4"
15'-0"
49'-8"
10'-4'
105'-0'
69'-8
SIDE PROPERTY LINE
SIDE PROPERTY LINE
MASONRY SHOP
FINISH FLOOR ELEV. 99.75
SCALE : 1/8" = 1'-0"
NORTH
REMOVE
LEAVE
23'-0"
10'-4"
4'-6
3'-6
3'-0
PLANTER
75'-0"
ELEV. 98.0 BM
ELEV. 98.0
EXISTING SIDEWALK

ASSIGNMENT SHEET #3

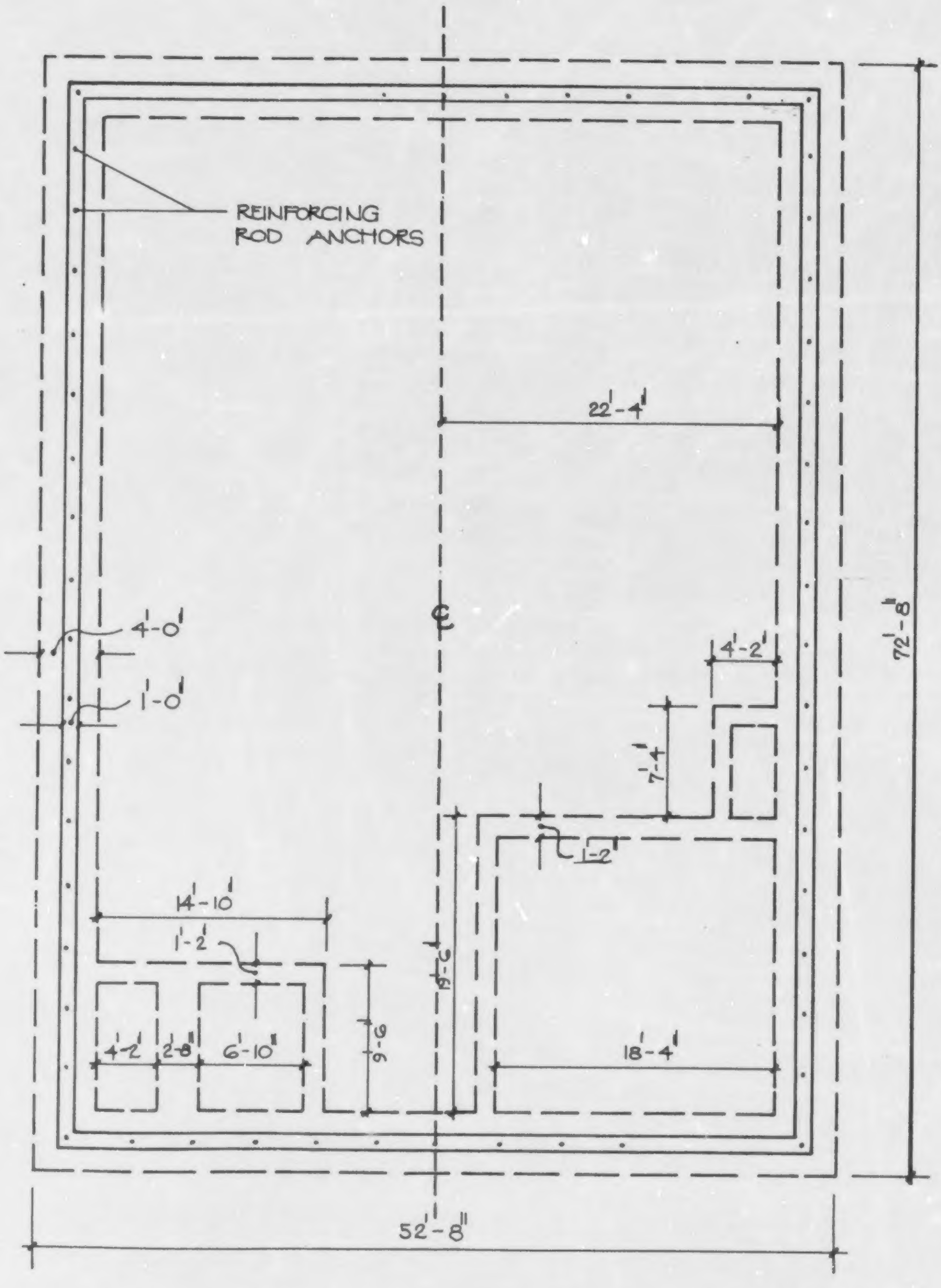
BLC · 401·B

PLOT PLAN

Sheet #1

ASSIGNMENT SHEET #3

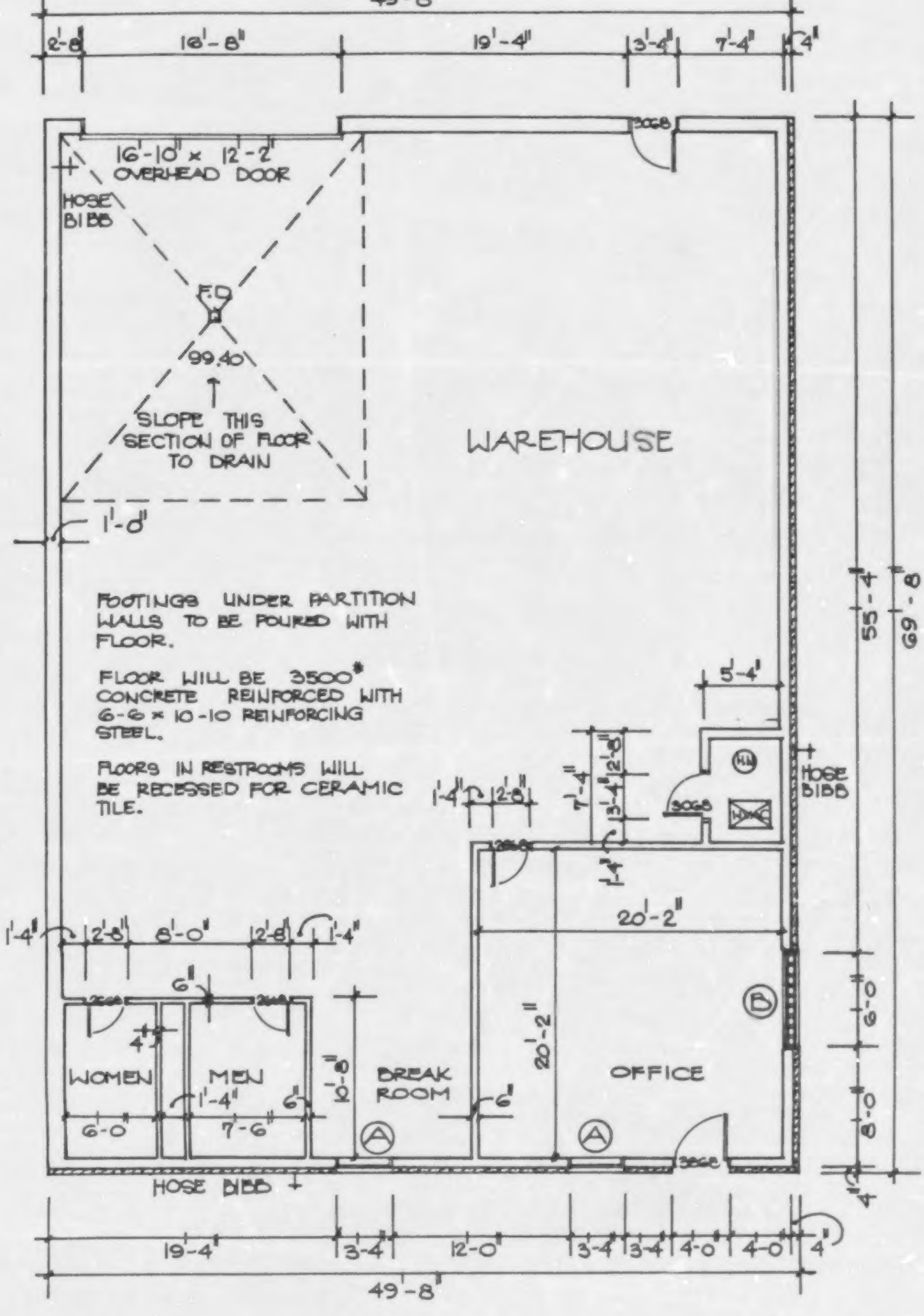
BLC · 403-B


REINFORCING ROD ANCHORS
22'-4"
℄
4'-0"
1'-0"
4'-2"
7'-4"
1'-2"
72'-8"
14'-10"
1'-2"
19'-6"
9'-6"
4'-2"
2'-8"
6'-10"
18'-4"
52'-8"

FOUNDATION PLAN

SCALE: 1/8" = 1'-0"

NORTH


49'-8"
2'-8"
16'-8"
19'-4"
3'-4"
7'-4"
4"
16'-10" × 12'-2" OVERHEAD DOOR
HOSE BIBB
F.D.
99.40
SLOPE THIS SECTION OF FLOOR TO DRAIN
WAREHOUSE
3068
1'-0"
55'-4"
69'-8"
5'-4"
2'-8"
3'-4"
7'-4"
1'-4"
2'-8"
HOSE BIBB
3068
1'-4"
2868
20'-2"
20'-2"
1'-4"
2'-8"
8'-0"
2'-8"
1'-4"
6"
2068
2468
4"
WOMEN
MEN
1'-4"
6"
8'-0"
BREAK ROOM
6"
OFFICE
6'-0"
7'-6"
A
A
B
3068
6'-0"
8'-0"
4"
HOSE BIBB
19'-4"
3'-4"
12'-0"
3'-4"
3'-4"
4'-0"
4'-0"
4"
49'-8"
NORTH

FOOTINGS UNDER PARTITION WALLS TO BE POURED WITH FLOOR.

FLOOR WILL BE 3500# CONCRETE REINFORCED WITH 6-6 × 10-10 REINFORCING STEEL.

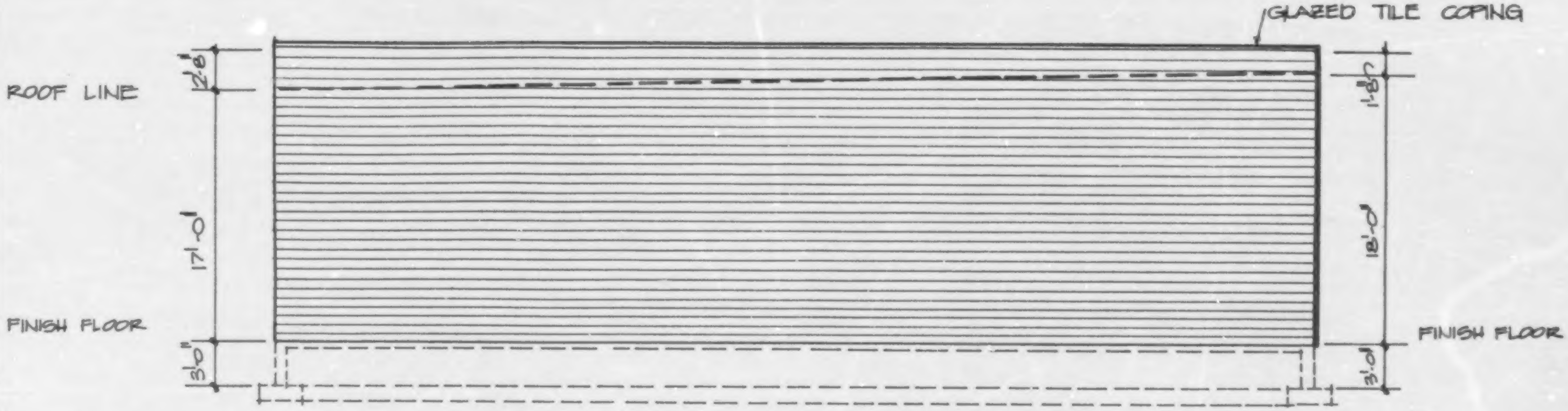
FLOORS IN RESTROOMS WILL BE RECESSED FOR CERAMIC TILE.

FLOOR PLAN

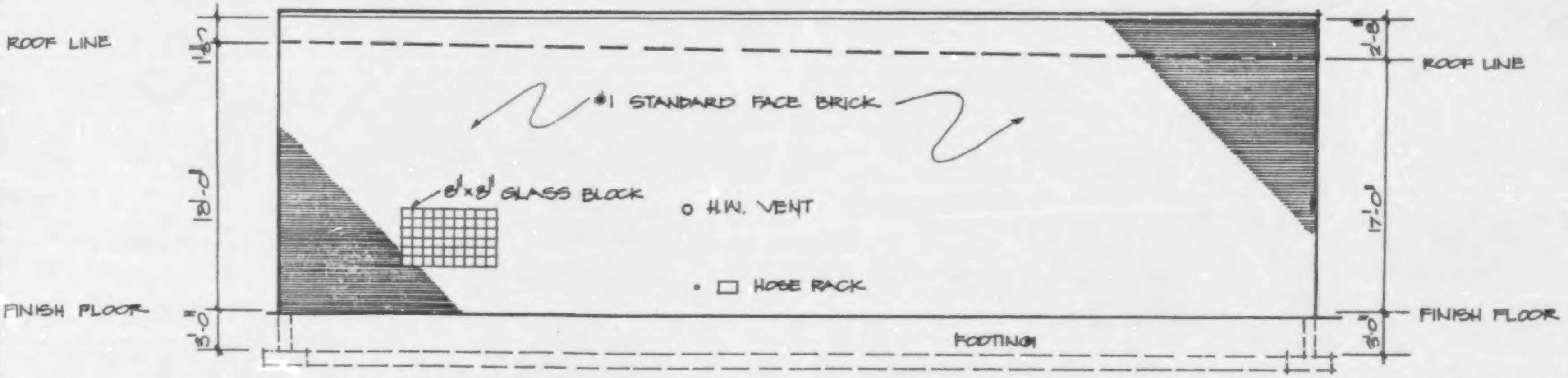
SCALE: 1/8" = 1'-0"

ASSIGNMENT SHEET #3

ELEVATIONS


GLAZED TILE COPING
ROOF LINE
2'-8"
17'-0"
FINISH FLOOR
3'-0"
1'-8"
18'-0"
FINISH FLOOR
3'-0"

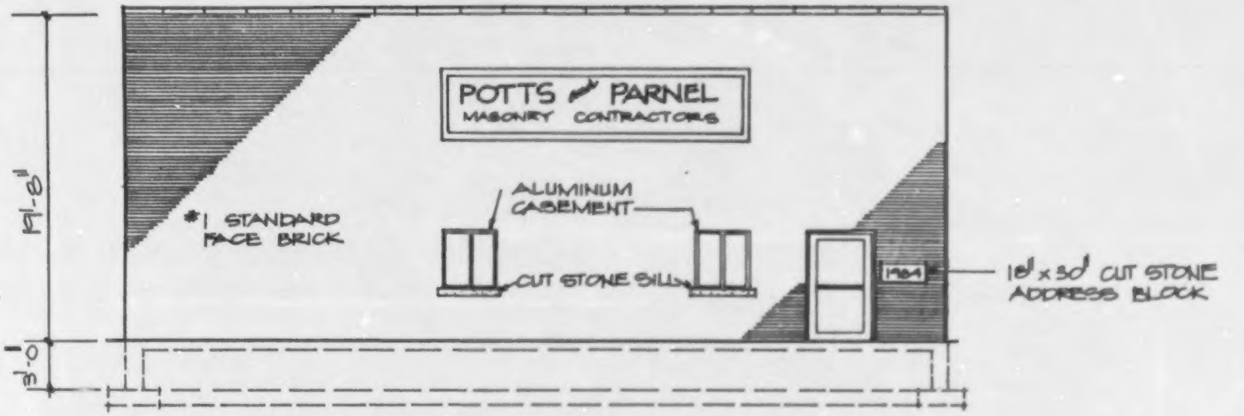
WEST ELEVATION
SCALE: 1/8" = 1'-0"


ROOF LINE
1'-8"
18'-0"
FINISH FLOOR
3'-0"
#1 STANDARD FACE BRICK
8"x8" GLASS BLOCK
H.W. VENT
HOSE RACK
2'-8"
ROOF LINE
17'-0"
FINISH FLOOR
3'-0"
FOOTING

EAST ELEVATION
SCALE: 1/8" = 1'-0"

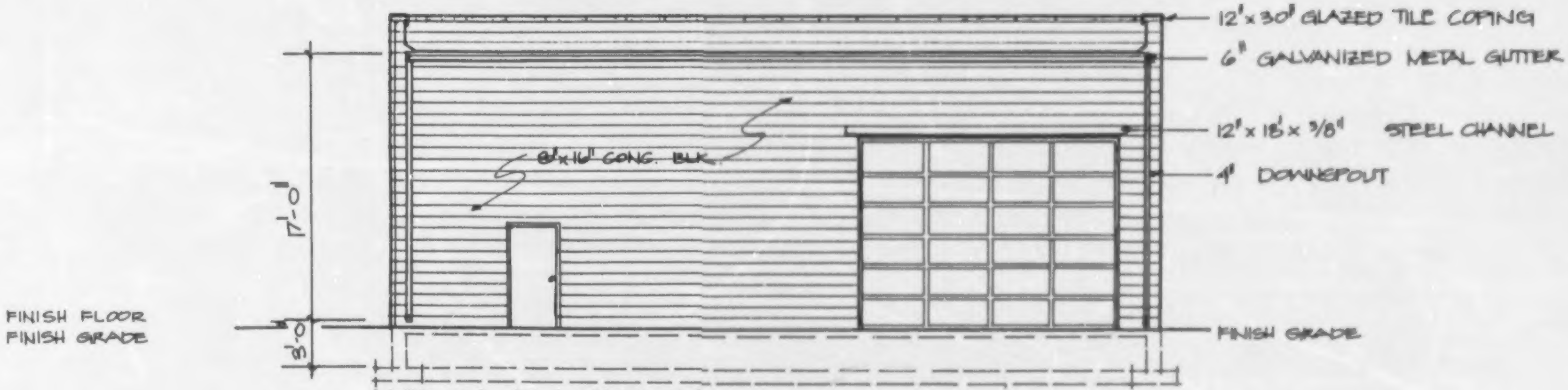
ASSIGNMENT SHEET #3

ELEVATIONS
(CONTINUED)


POTTS and PARNEL
MASONRY CONTRACTORS
ALUMINUM CASEMENT
#1 STANDARD FACE BRICK
CUT STONE SILL
18" x 30" CUT STONE ADDRESS BLOCK
19'-8"
3'-0"

SOUTH ELEVATION

SCALE: 1/8" = 1'-0"

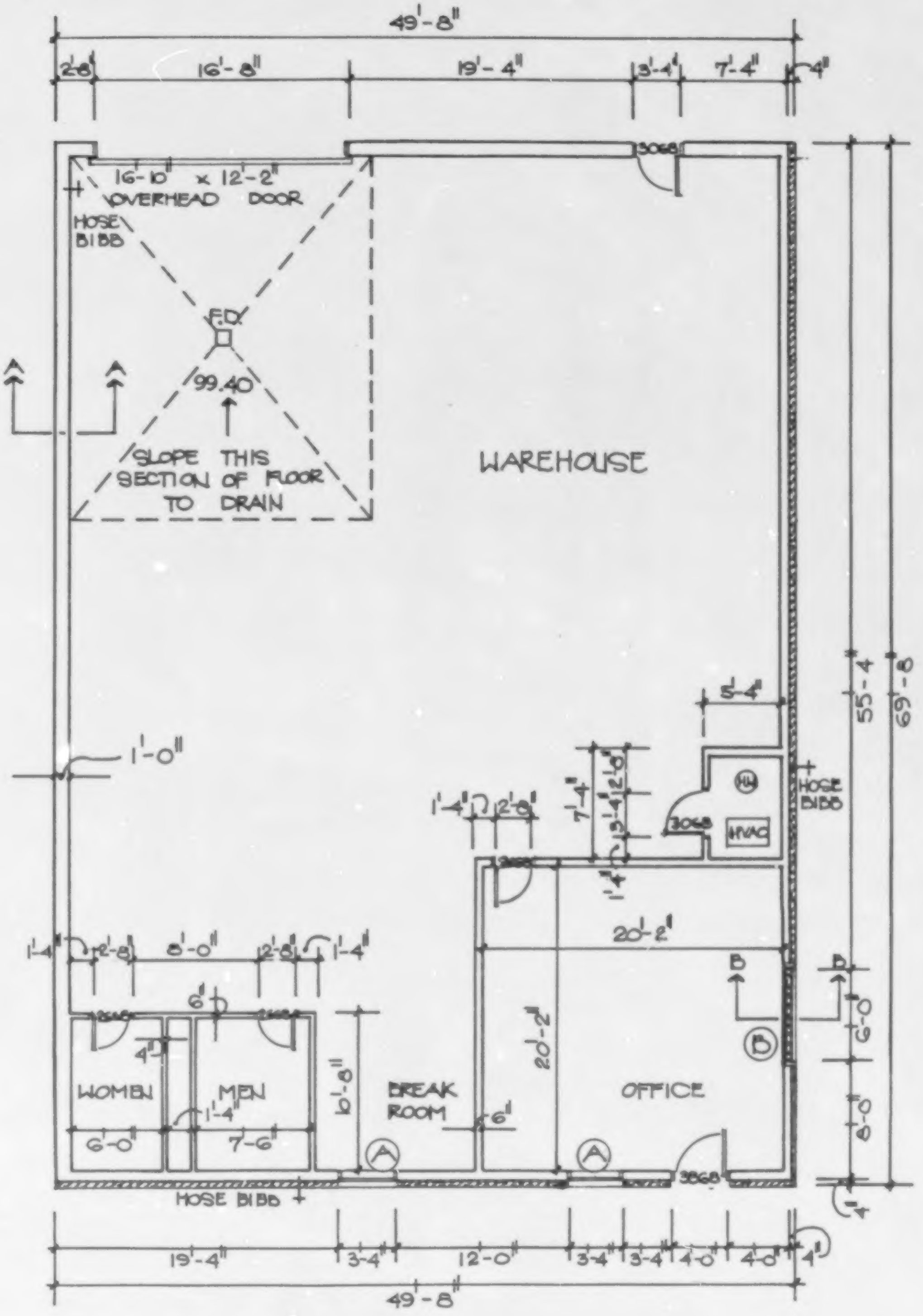

12" x 30" GLAZED TILE COPING
6" GALVANIZED METAL GUTTER
12" x 18" x 3/8" STEEL CHANNEL
4" DOWNSPOUT
8"x16" CONC. BLK.
17'-0"
3'-0"
FINISH FLOOR
FINISH GRADE
FINISH GRADE

NORTH ELEVATION

SCALE: 1/8" = 1'-0"

ASSIGNMENT SHEET #3

BLC-411-B


49'-8"
2'-8"
16'-8"
19'-4"
3'-4"
7'-4"
4"
3068
16'-10" x 12'-2" OVERHEAD DOOR
HOSE BIBB
F.D.
99.40
SLOPE THIS SECTION OF FLOOR TO DRAIN
WAREHOUSE
55'-4"
69'-8"
1'-0"
5'-4"
HW
HOSE BIBB
3068
HVAC
1'-4"
2'-8"
7'-4"
13'-4"
2'-0"
1'-4"
20'-2"
1'-4"
2'-8"
8'-0"
2'-8"
1'-4"
6"
4"
WOMEN
MEN
1'-4"
6'-0"
7'-6"
10'-8"
BREAK ROOM
6"
A
A
20'-2"
OFFICE
B
B
B
6'-0"
8'-0"
4"
3068
HOSE BIBB
19'-4"
3'-4"
12'-0"
3'-4"
3'-4"
4'-0"
4'-0"
4"
49'-8"

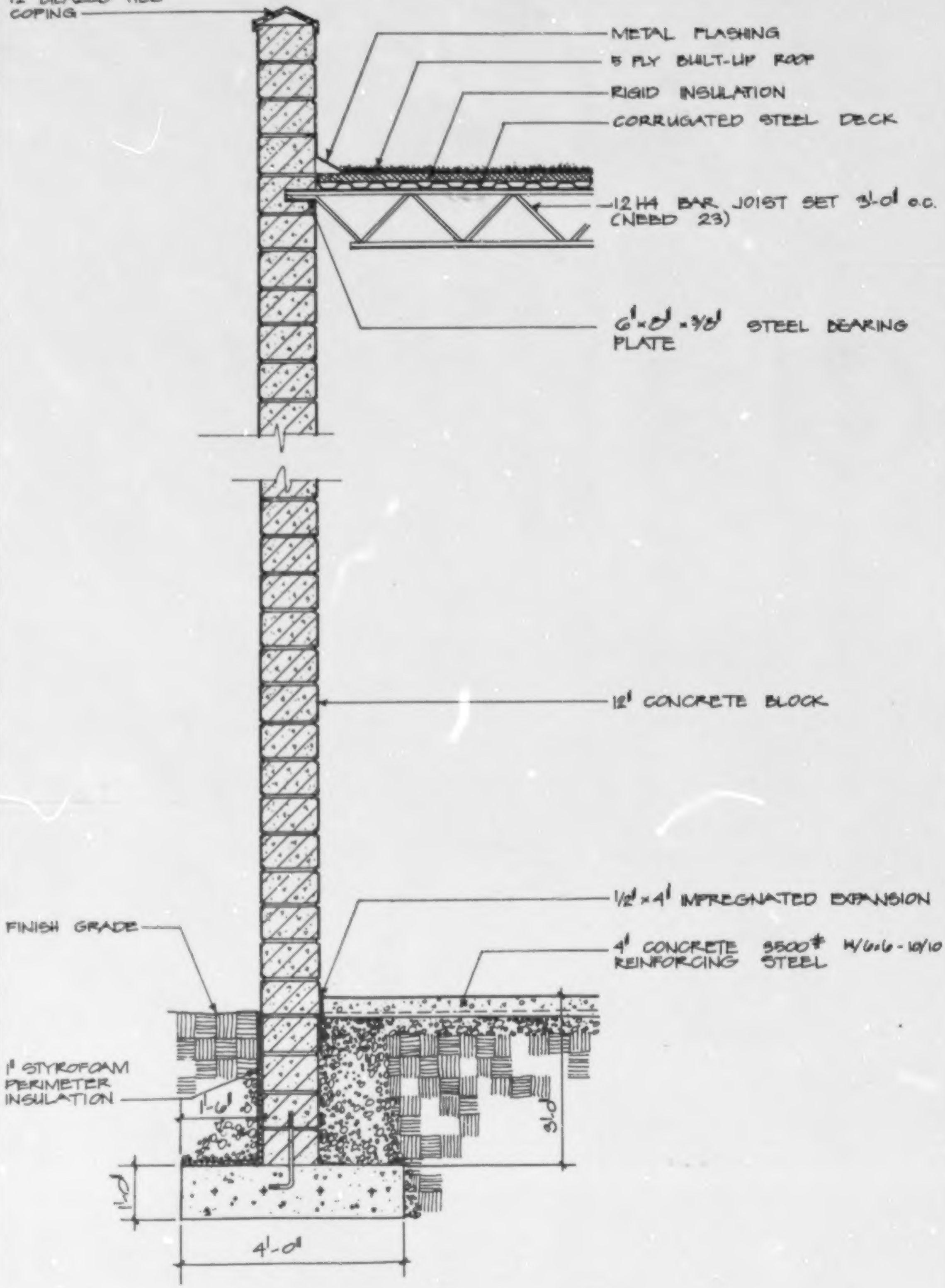
SECTION DRAWING

NORTH

SCALE: 1/8" = 1'-0"

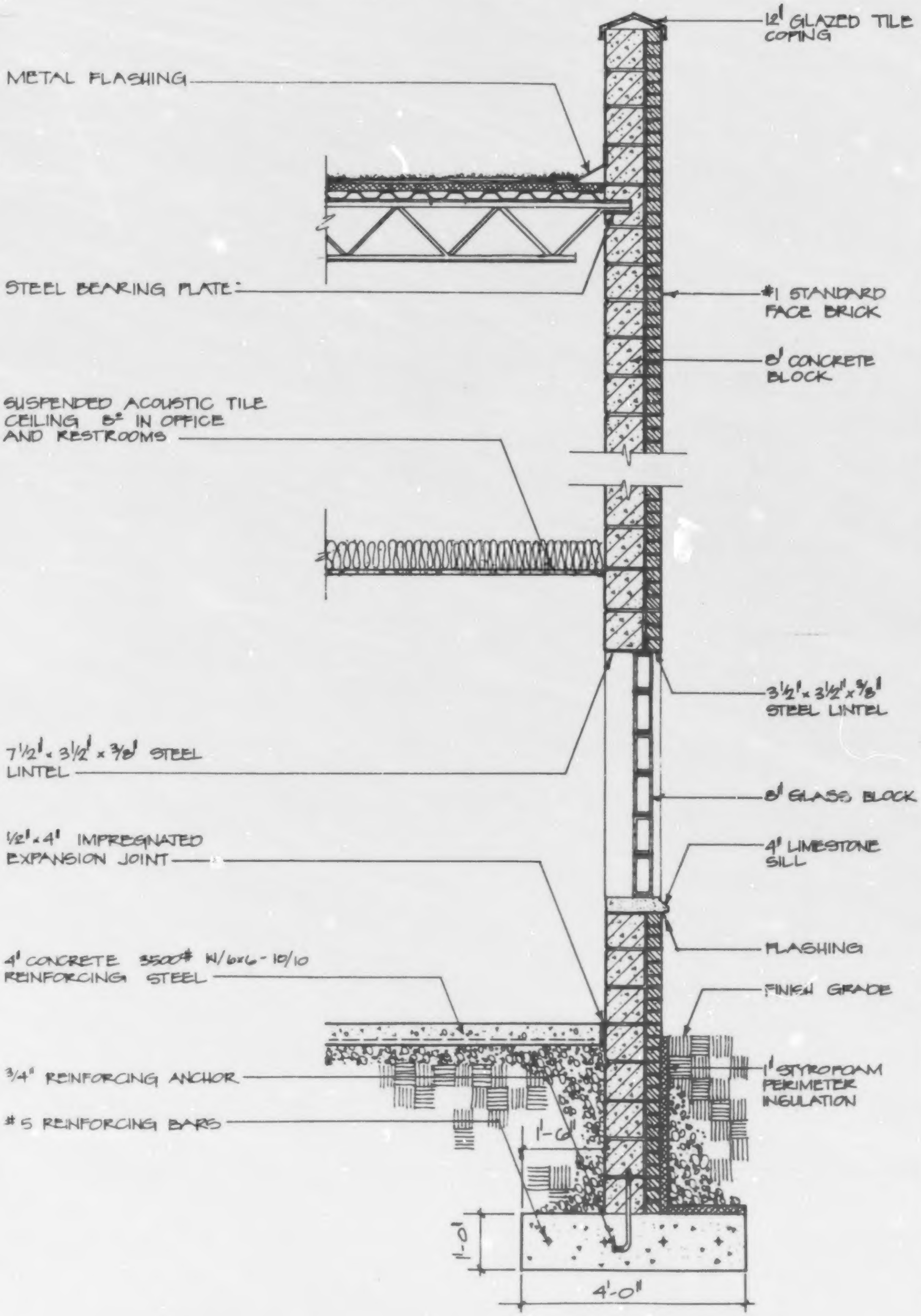
Sheet #6

SECTION DRAWING
(CONTINUED)


12" GLAZED TILE COPING
METAL FLASHING
5 PLY BUILT-UP ROOF
RIGID INSULATION
CORRUGATED STEEL DECK
12H4 BAR JOIST SET 3'-0" o.c. (NEBD 23)
6" × 8" × 3/8" STEEL BEARING PLATE
12" CONCRETE BLOCK
1/2" × 4" IMPREGNATED EXPANSION
4" CONCRETE 3500# W/6×6 - 10/10 REINFORCING STEEL
FINISH GRADE
1" STYROFOAM PERIMETER INSULATION
1'-6"
3'-0"
1'-0"
4'-0"

SECTION AA 561 SCALE: 1/2" = 1'-0"

SECTION DRAWING
(CONTINUED)


12" GLAZED TILE COPING
METAL FLASHING
STEEL BEARING PLATE
#1 STANDARD FACE BRICK
8" CONCRETE BLOCK
SUSPENDED ACOUSTIC TILE CEILING 8' IN OFFICE AND RESTROOMS
3 1/2" x 3 1/2" x 3/8" STEEL LINTEL
7 1/2" x 3 1/2" x 3/8" STEEL LINTEL
8" GLASS BLOCK
1/2" x 4" IMPREGNATED EXPANSION JOINT
4" LIMESTONE SILL
FLASHING
4" CONCRETE 3500# W/6x6 - 10/10 REINFORCING STEEL
FINISH GRADE
3/4" REINFORCING ANCHOR
1" STYROFOAM PERIMETER INSULATION
#5 REINFORCING BARS
1'-6"
1'-0"
4'-0"

SECTION BB

562

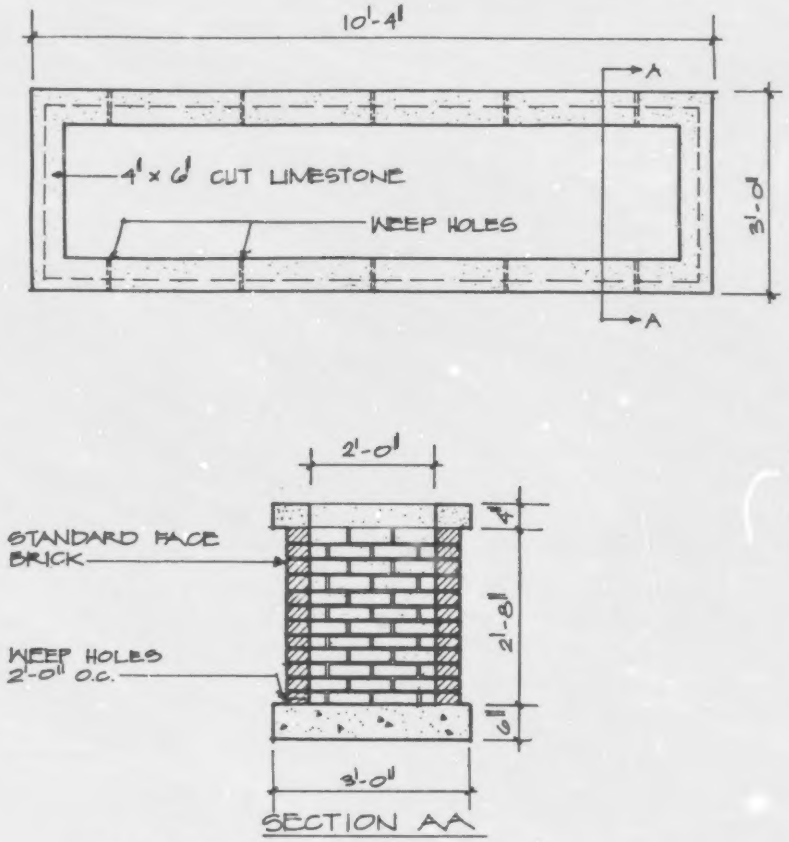
SCALE: 1/2" = 1'-0"

ASSIGNMENT SHEET #3

BLC - 415-B

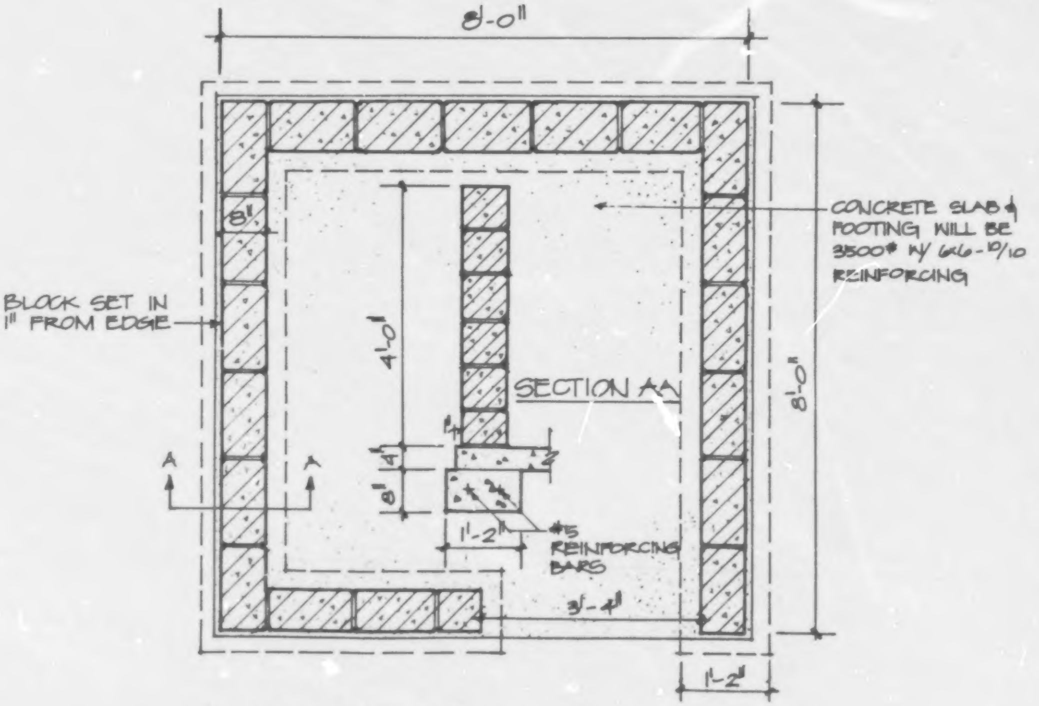
ASSIGNMENT SHEET #3

BLC - 417-B


10'-4"
A
A
4" x 6" CUT LIMESTONE
WEEP HOLES
3'-0"
2'-0"
STANDARD FACE BRICK
WEEP HOLES 2'-0" O.C.
4"
2'-8"
6"
3'-0"
SECTION AA

PLANTER DETAILS

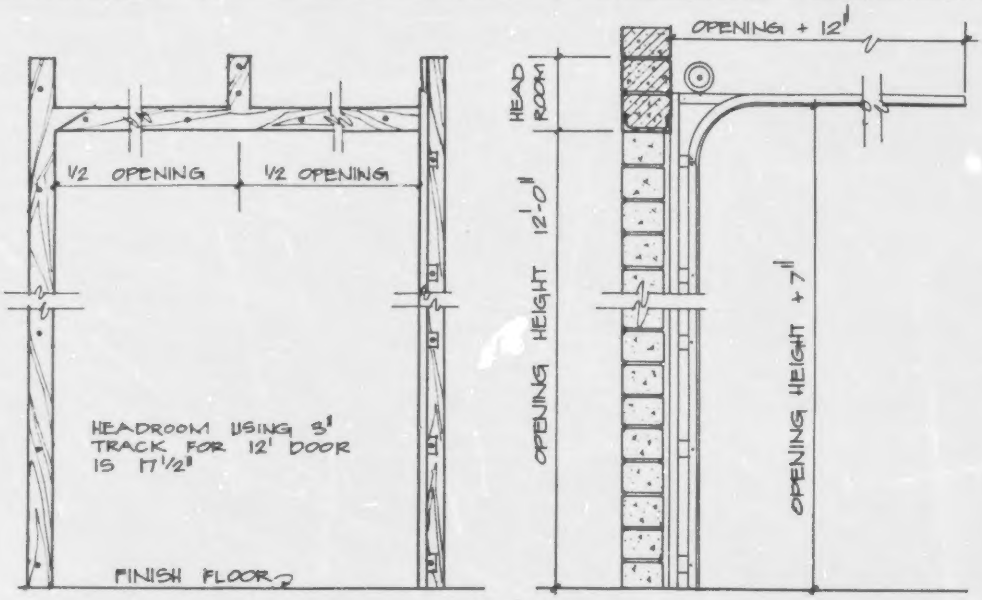
SCALE: 1/2" = 1'-0"


8'-0"
8"
BLOCK SET IN 1" FROM EDGE
CONCRETE SLAB & FOOTING WILL BE 3500# W/ 6x6-10/10 REINFORCING
4'-0"
SECTION AA
4"
8"
1'-2"
#5 REINFORCING BARS
A
A
3'-4"
8'-0"
1'-2"

TRASH BIN DETAILS

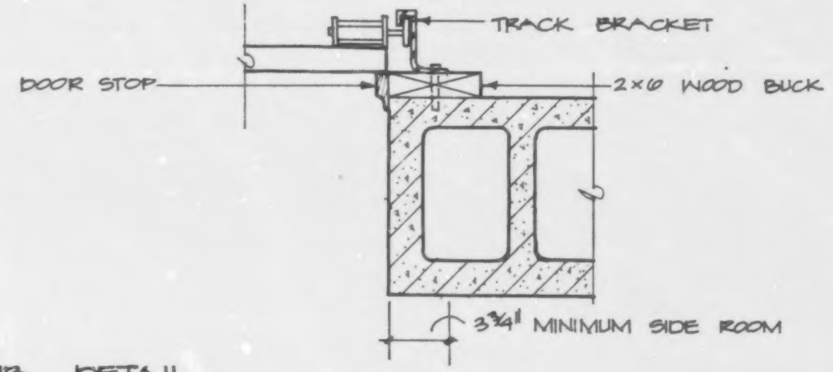
SCALE: 1/2" = 1'-0"

563


1/2 OPENING
1/2 OPENING
HEADROOM USING 3' TRACK FOR 12' DOOR IS 17 1/2"
FINISH FLOOR
OPENING + 12"
HEAD ROOM
OPENING HEIGHT 12'-0"
OPENING HEIGHT + 7"

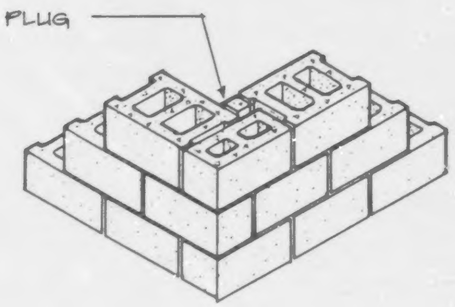
OVERHEAD DOOR

SCALE: 3/8" = 1'-0"


TRACK BRACKET
DOOR STOP
2×6 WOOD BUCK
3 3/4" MINIMUM SIDE ROOM

JAMB DETAIL

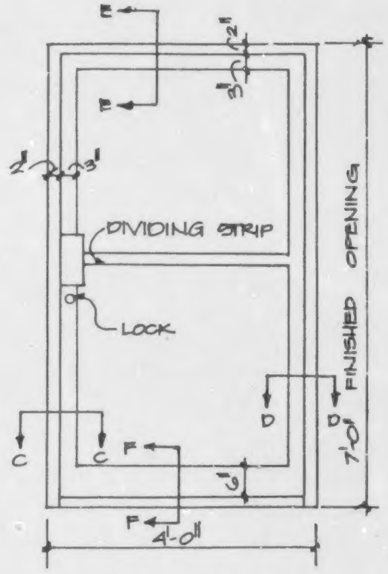
SCALE: 1 1/2" = 1'-0"



CORNER CONSTRUCTION DETAIL

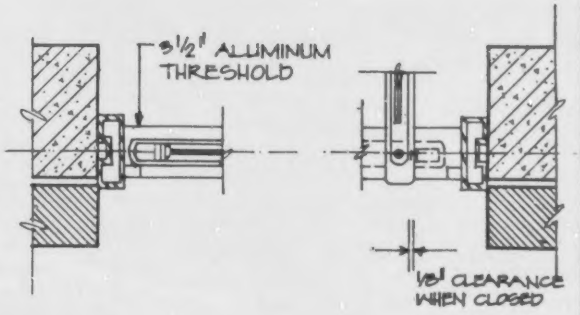
SCALE: 1/2" = 1'-0"

DETAILS
(CONTINUED)


E
E
2"
3"
2"
3"
DIVIDING STRIP
LOCK
D
D
C
C
F
F
3"
7'-0" FINISHED OPENING
4'-0"

FRAMED DOOR

SCALE: 1/2" = 1'-0"

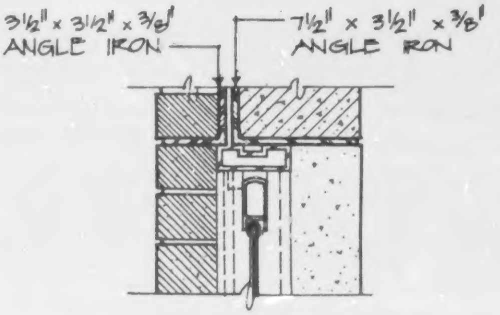

3½" ALUMINUM THRESHOLD
1/8" CLEARANCE WHEN CLOSED

SECTION CC

SECTION DD

DOOR JAMBS

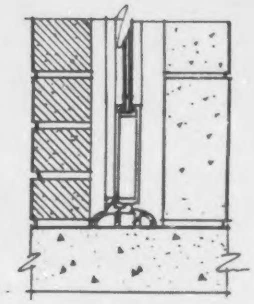
SCALE: 1½" = 1'-0"


3½" x 3½" x 3/8" ANGLE IRON
7½" x 3½" x 3/8" ANGLE IRON

SECTION EE

DOOR HEADER

SCALE: 1½" = 1'-0"



SECTION FF

DOOR SILL

SCALE: 1½" = 1'-0"

DETAILS

(CONTINUED)

SCHEDULES

FINISH SCHEDULE

DOOR SCHEDULE

Symbol	Width	Height	Thickness	Material	Type	Quantity	Threshold	Remarks	Manufacturer
2668	2'-6"	6'8"	1⅜"	Wood-with vents	Slab core	3	None	Oil stain	
3068	3'0"	6'-8"	1⅜"	Wood-mahogany	Slab core	1	None	Oil stain	
3068	3'-0"	6'-8"	1¾"	Metal clad		1	Concrete	Pre-finish	
3868	3'-8"	6'-8"	1¾"	Alum & glass	Ins. plate glass	1	Aluminum	None	
Over head	16'-10"	12'-2"				1	None	Oil stain	Clopay Model 900

WINDOW SCHEDULE

Symbol	Width	Height	Screen	Material	Type	Quantity	Remarks	Manufacturer	Catalog number
A	1'-8"	3'-8"	No	Aluminum	Casement	2-double			
B	6'-0"	4'-0"	No	Glass	Glass block	1		Stillburg plate glass	

LINTEL SCHEDULE

Steel	2	3½" x 3½" x ⅜" x 4'-0"
Steel	1 ea.	3½" x 3½" x ⅜" x 4'-8" 3½" x 7½" x ⅜" x 4'-8"
Steel	1 ea.	3½" x 3½" x ⅜" x 6'-8" 3½" x 7½" x ⅜" x 6'-8"
Concrete	3	6" x 8" x 4'-0"
Concrete	2	8" x 8" x 4'-8"
Concrete	1 ea.	6" x 8" x 4'-8" 12" x 8" x 4'-8"
Channel iron and rein. concrete	1	12" x 8" x 18'-0"

ROOM FINISHES

Rooms		Floors			Ceilings				Wall					Base		Trim			Remarks
	CERAMIC TILE	RUBBER TILE	CARPET	CONCRETE	ACOUSTIC TILE	WOOD	NONE		WOOD PANEL	WALL BOARD	WALL PAPER	PAINTED BLOCK	CERAMIC TILE	CERAMIC TILE	WOOD	RUBBER	WOOD	PLASTIC	
Office			✓		✓				✓						✓		✓		Owner will choose carpet walnut wainscot
Break Rm.		✓					✓			✓		✓				✓	✓		Use water-resistant finish
Womens Rm.	✓				✓								✓	✓			✓		
Mens Rm.	✓				✓								✓	✓			✓		
Furnace Rm.				✓			✓						✓						
Warehouse				✓			✓					✓							Use water-resistant finishes

ESTIMATING
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

(NOTE: Because of the methods and variations used for estimating, these answers serve only as a guideline for the instructor. All work and answers will be evaluated to the satisfaction of the instructor.)

Assignment Sheet #1

A. 6199.29 bricks

B. Order 6200 bricks

C. 37.20 (order 38 bags of cement)

D. 4.75 (order 5 tons of sand)

Assignment Sheet #2

A. 1145.562 blocks

B. Order 1145 blocks

C. 25.444 (order 26 bags of cement)

D. 3.25 (order 3 1/4 tons)

ANSWERS TO ASSIGNMENT SHEETS

QUANTITY ESTIMATE

PROJECT Masonry Shop ESTIMATE NO.

LOCATION 1982 4th Street SHEET NO. 1 of 2

NAME SCORE DATE

DESCRIPTION	DIMENSIONS LENGTH	 HEIGHT	QUANT.	UNIT PRICE	TOTAL EST. MATERIAL COST	UNIT PRICE	TOTAL EST. LABOR COST	TOTAL
Exterior								
12" concrete block			2647-263	for	openings = 2384 +	.05 waste	(119) =	2503
4" 1/2 partition block			34					
4"x4"x8" concrete plugs			34					
8" concrete block			3058-87	for op	enings = 2917 +	.05 waste	(148) =	2826
Glass block			54					
Standard brick			18,156-	522 for	openings = 17634 +	.10 waste	(1763) =	19,397
Limestone sills								
4"x5½"x5'-11⅝"			1					
4"x5½"x3'-3⅝"			2					
Lintels								
12"x⅜"x18' steel channel			1					
3½"x3½"x⅜"x4'-0"∠			2					
3½"x3½"x⅜"x4'-8"∠			1					
3½"x7½"x⅜"x4'-8"∠			1					
3½"x3½"x⅜"x6'-8"∠			1					
3½"x7½"x⅜"x6'-8"∠			1					
6"x8"x4'-0" concrete			3					
8"x8"x4'-8" concrete			2					
6"x8"x4'-8" concrete			1					
12"x8"x4'-8" concrete			1					
Terra Cotta Coping			76					
Address block			1					
Mason Cement (Bags)					335 bags			
Sand (Tons)					51 tons			
Anchor Reinforcing bars			39					
Wall ties			1400	Veneer	type			
Anchors or Reinforcing	Furnished							

ANSWERS TO ASSIGNMENT SHEETS

QUANTITY ESTIMATE

PROJECT Masonry Shop ESTIMATE NO.

LOCATION 1982 4th Street SHEET NO. 2 of 2

NAME SCORE DATE

DESCRIPTION	DIMENSIONS		QUANT.	UNIT PRICE	TOTAL EST. MATERIAL COST	UNIT PRICE	TOTAL EST. LABOR COST	TOTAL
	LENGTH	HEIGHT						
Interior								
6" concrete block			634-	85 for	openings = 549 +	.05 waste	(27) =	522
6" 1/2 block			75					
6" L. Corners			36					
4" partition block			180					
4" 1/2 partition block			12					
Bearing plates			46					
Trash Bin								
8" concrete block			114					
8" 1/2 block			6					
Planter								
Standard brick			584					
Weephole material			10 pcs					
Limestone coping			8	24"				
			4	26"				

ESTIMATING
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with estimating to their correct definitions. Write the correct numbers in the blanks.

_____a. Based on a nominal 4-inch spacing

_____b. Space occupied by a body; expressed in cubic units

_____c. Rough, irregular-shaped stone

_____d. To solve by mathematical process

_____e. Theoretical size that may vary from the actual size

_____f. Group of symbols expressing a single concept or mathematical fact

_____g. Relationship in quantity, amount, or size between two or more things; expressed with ratio symbol

_____h. Measure of a flat surface; expressed in square units

_____i. Relating to a straight line or length

_____j. Determining amount of material needed to complete a specific job

_____k. Unit with three dimensions including length, width and height

_____l. Exterior or upper boundary of an object or body

_____m. To adjust in size relative to other parts or things

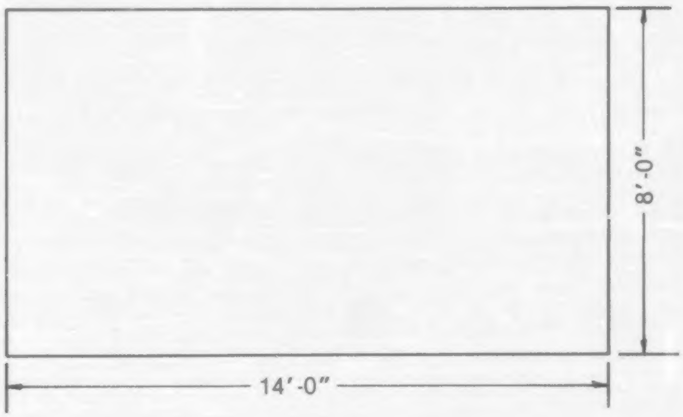
1. Rubblestone
2. Proportion
3. Formula
4. Modular
5. Cubic unit
6. Area
7. Linear
8. Nominal size
9. Estimating
10. Volume
11. Ratio
12. Surface
13. Calculate

TEST

2. Calculate areas of square or rectangular surfaces. Use the formula Length × Width = Area.

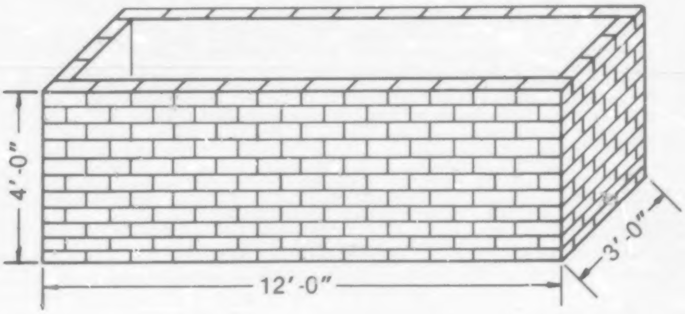
   a. Find the area of the wall illustrated.

   A = ______________________________



   b. Find the total area of the planter illustrated.

   A = ______________________________



TEST

c. Find the area of the face of a retaining wall 124′-6″ long × 5′-6″ high.

A = ____________________________

3. Calculate basic problems dealing with estimating. Write answers in the blanks.

a. Estimate number of standard bricks for an 8-inch wall 44′-0″ long × 10′-4″ high finished both sides. Use conversion factor 6.75, and allow 0.25 for breakage and waste. Write number of bricks to order.

Bricks = ____________________________

TEST

b. Estimate number of concrete stretcher blocks for a garage 24′-0″ × 24′-0″ × 9′-4″. One wall will have one door 3′-0″ × 6′-8″. One wall will have two windows 2′-6″ × 4′-0″. One wall will have one window 4′-0″ × 4′-0″. One wall will have an overhead door 12′-0″ × 7′-4″. Use conversion factor 1.125. Write number of blocks to order.

Blocks = ______________________________

c. Using Table 2 in Information Sheet, Section III, estimate cubic feet of mortar needed for a 4-inch wall with 1,698 square feet using standard brick with ½″ joints.

Mortar = ______________________________

d. Estimate amounts of materials needed per cubic foot of mortar using Table 3 in Information Sheet, Section III.

1) How much cement is needed for 129.89 cubic feet of Type O mortar?

Cement = ______________________________

2) How much lime is needed for 129.89 cubic feet of Type O mortar?

Lime = ______________________________

TEST

3) How much sand is needed for 129.89 cubic feet of Type O mortar?

Sand = ______________________

e. Estimate block units using Table 1 in Information Sheet, Section III.

1) How many units are needed for 1,500 square feet of wall using 7⁵/₈" × 7⁵/₈" × 15⁵/₈" blocks with ³/₈" mortar joints?

Blocks = ______________________

2) How much mortar is needed for this number of blocks?

Mortar = ______________________

4. List five rule of thumb guidelines used by the bricklayer when estimating materials.

a. ____

____

b. ____

____

c. ____

____

d. ____

____

e. ____

____

(NOTE: Test questions 5-7 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

5. Estimate material for a specific brick job.

6. Estimate material for a specific block job.

7. Use a set of plans to take off and estimate all masonry materials.

ESTIMATING
UNIT IV

ANSWERS TO TEST

1. a. 4
   b. 10
   c. 1
   d. 13
   e. 8
   f. 3
   g. 11
   h. 6
   i. 7
   j. 9
   k. 5
   l. 12
   m. 2

2. a. 112 sq ft
   b. 120 sq ft
   c. 684.75 or 684$^{3}/_{4}$ sq ft

3. (NOTE: Because of the methods and variations used for estimating, these answers serve only as a guideline for the instructor. Answers will be evaluated to the satisfaction of the instructor.)
   a. 7670.02 (Order 7670 face bricks)
   b. 845.64 (Order 846 blocks)
   c. 129.89 cu ft
   d. 1. 14.28 cu ft cement
      2. 28.57 cu ft lime
      3. 128.59 cu ft sand
   e. 1. 1687.5 blocks
      2. 39 cu ft mortar

4. Answer should include any five of the following
   a. Length × height − openings = square feet of area to cover
   b. Square feet × 1.125 = number of blocks in a wall
   c. Square feet × 1.2 = number of blocks including waste

ANSWERS TO TEST

d. Height of wall ÷ 0.67 ($^2/_3$) = number of block courses high

e. Length of wall × 0.75 ($^3/_4$) = number of blocks in length

f. Blocks in length × courses high = number of blocks needed

g. A bricklayer can lay 30 blocks per bag of masonry cement; divide number of blocks by 30 to find how much masonry cement to order

h. Every eight bags of masonry cement requires 1 ton of sand

i. It takes 1 ton of sand to lay 1,000 bricks

j. It takes eight bags of masonry cement to lay 1,000 bricks

5. Evaluated to the satisfaction of the instructor

6. Evaluated to the satisfaction of the instructor

7. Evaluated to the satisfaction of the instructor

ARC WELDING
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to select equipment needed to perform different types of welding jobs. The student will show this knowledge by completing job sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with arc welding to their correct definitions.
2. Write meanings of abbreviations associated with arc welding.
3. State safety precautions to observe when welding.
4. Name types of arc-welding machines.
5. Select from a list common tools and equipment used in arc welding.
6. Match to their correct definitions terms associated with welding materials.
7. List types of electrodes.
8. Select from a list common sizes of electrodes used in arc welding.
9. Interpret meanings of numbers in the electrode classification system.
10. Distinguish between reverse and straight polarity.
11. Select from a list factors that determine correct polarity to use.
12. Select from a list purposes of electrode flux.
13. List factors to consider when selecting electrodes.
14. Describe effects of raising and lowering welding machine amperes.
15. Name methods of striking an arc.
16. Select from a list characteristics of proper arc length.
17. Identify parts of the welding process.
18. Match types of welds to their correct descriptions.

OBJECTIVE SHEET

19. Label types of welds.
20. Label types of weld joints.
21. Label parts of groove and fillet welds.
22. List positions used in arc welding.
23. List reasons for poor welds.
24. List types of electrode motions (rod manipulations).
25. State characteristics of a good weld.
26. Demonstrate the ability to
    a. Start, stop, and restart a bead.
    b. Construct a pad weld.
    c. Construct a butt weld.
    d. Construct a lap-joint fillet weld in the overhead position.
    e. Construct a T-joint fillet weld in the vertical up position.
    f. Construct a square-groove butt-joint weld in the vertical down position.

ARC WELDING
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order films and other materials that may be needed for reference and motivation. Be sure to obtain an *Electrode Guidebook.*

(NOTE: Manufacturers and equipment dealers are the best sources for these materials.)

B. Obtain transparencies.

(NOTE: Transparencies are available from AGC and CIMC.)

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and job sheets.

F. Discuss information sheet.

G. Gather equipment and materials needed for job sheet demonstrations.

H. Demonstrate and discuss procedures outlined in job sheets.

I. Discuss the different lens-shade selections for welding shield or helmet.

EXAMPLE:

LENS-SHADE SELECTOR

Type of Operation	Shade Number
Soldering	2
Torch brazing	3 or 4
Oxygen cutting	
0 to 1 inch	3 or 4
1 to 6 inches	3 or 5
6 inches and over	5 or 6
Gas welding	
0 to 1/3 inch	4 or 5
1/8 to 1/2 inch	5 or 6
½ inch and over	6 or 8
Shielded metal-arc welding 1/16-, 3/4-, 1/8-, 5/32-inch electrodes	9 to 14
Gas-metal arc welding	9 to 14
Gas-tungsten arc welding nonferrous gas-metal arc welding 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	9 to 14
Gas-tungsten arc welding (ferrous), gas-metal arc welding (ferrous) 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	9 to 14

SUGGESTED ACTIVITIES

J. Give test.

K. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM #1 — Welding Equipment
2. TM #2 — Welding Circuit
3. TM #3 — AWS Classification of Electrodes
4. TM #4 — Welding Process
5. TM #5 — Welding Positions
6. TM #6 — Weld Quality Inspection: Good Welds

E. Job sheets

1. Job Sheet #1 — Start, Stop, and Restart a Bead
2. Job Sheet #2 — Construct a Pad Weld
3. Job Sheet #3 — Construct a Butt Weld
4. Job Sheet #4 — Construct a Lap-Joint Fillet Weld in the Overhead Position
5. Job Sheet #5 — Construct a T-Joint Fillet Weld in the Vertical Up Position
6. Job Sheet #6 — Construct a Square-Groove Butt-Joint Weld in the Vertical Down Position

F. Test

G. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

A. Hendrix, Laborn J., "Bud." *Heavy Equipment Mechanics*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1982.

B. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator Instructional Materials*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1981.

C. Hendrix, Laborn J., "Bud." *Millwright Instructional Materials*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and the Associated General Contractors of America, 1980.

D. Jefferson, T.B. *The Welding Encyclopedia*. Morton Grove, Illinois: Monticello Books, 1968.

ARC WELDING
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Arc — Flow of current across a narrow gap, usually from tip of electrode to base metal

B. Arc length — Distance from end of electrode to point where arc makes contact with work surface

C. Arc welding — Joining of two or more pieces of metal by fusion process

(NOTE: Arc welding is sometimes referred to as *shielded metal-arc welding, SMAW,* or *stick welding*.)

D. Bevel — Angular cut made on the vertical edge of base metal to allow better weld penetration

E. Butt joint — Weld between two metal joints on the same plane

F. Crater — Depression at termination of weld

G. Ductile — Capable of being drawn or stretched

H. Electrode — Metal rod that conducts a current from electrode holder to base metal

(NOTE: The metal rod melts and deposits metal in a bead.)

I. Flux — Coating on outside of electrode; chemical used to promote fusion during welding process

J. Fusion process — Process of heating metal to a molten state and allowing it to cool

(NOTE: In arc welding, the heat is produced by the electric arc.)

K. Gaseous shield — Gas given off by melting of electrode flux

L. Heat line (heat-affected zone) — That part of base metal altered by heat from welding, brazing, or cutting operations

M. Lead — Cables leading from ground clamp and holder to machine

N. Low-hydrogen electrode — Electrode with low hydrogen content; used when cracking is a potential problem

INFORMATION SHEET

O. Malleable — Capable of being worked into a different shape or form

P. Pass — Single longitudinal progression of a welding operation along a joint or weld deposit

Q. Penetration — Distance from original surface of base metal to that point at which fusion ceases

R. Polarity — Condition of being positive (+) or negative (−), as the ends of a magnet or electrical mechanism

S. Puddle — Portion of a weld that is molten at the place heat is applied

T. Rippled — Lightly ruffled or covered with small waves

U. Slag inclusion — Nonmetallic porous material trapped in weld metal or between weld metal and base metal

V. Wire core — Metal center of electrode

II. Abbreviations associated with arc welding

A. AC — Alternating current; electric current that reverses its direction at regular intervals

B. AWS — American Welding Society

C. DC — Direct current; electric current flowing in one direction only and mostly constant in value

D. OSHA — Occupational Safety and Health Act

E. psi — Pounds per square inch

III. Safety precautions to observe when welding

(NOTE: Observe OSHA safety rules.)

A. Do not look at arc or reflection without eye protection

B. Do not wear shield or helmet that is in bad condition

C. Do not chip slag without wearing safety goggles

D. Wear proper protective clothing

EXAMPLES: Welder's leather vest or jacket, long-sleeved shirt with collar and cuffs buttoned, leather gloves, high-topped shoes or boots

INFORMATION SHEET

E. Do not strike an arc until you have taken all safety precautions

F. Do not weld around combustible or flammable materials

G. Do not pick up hot metals with bare hands

H. Be sure that confined areas are properly ventilated

I. Disconnect plug before checking welding machine

J. Do not leave electrode holder on welding table or in direct contact with grounded metal

K. Do not use worn or frayed cables

L. Be sure that floor is dry; do not stand in water when welding

M. Keep work area clean

N. Keep tools and materials in proper locations

O. Dispose of electrode stubs properly

IV. Types of arc-welding machines

A. Alternating-current (AC) transformer welder

(NOTE: The welding current reverses direction of flow 120 times per second.)

B. Direct-current (DC) welder

(NOTE: The welding current flows in one direction.)

C. Motor generator

(NOTE: The motor generator produces DC current.)

D. Engine generator

(NOTE: The engine generator can produce either AC or DC current.)

E. AC/DC transformer rectifier

(NOTE: This welder, which is supplied by an AC power source, can be switched to produce either AC or DC welding current.)

INFORMATION SHEET

V. Common tools and equipment used in arc welding (Transparency #1)

  A. Welding machine

  B. Electrode holder with lead

  C. Ground clamp with lead

  D. Shield or helmet

  E. Leather gloves

  F. Chipping hammer

  G. Safety goggles

  H. Wire brush

  I. Electrode

  J. Protective clothing

VI. Terms and definitions associated with welding materials

  A. Alloy — Mixture of two or more elements, of which at least one is a metal

  B. Aluminum — Bluish, silver-white, malleable, ductile, light, trivalent metallic element

  C. Base metal — Metal to be cut or welded

  D. Cast iron — Commercial alloy of iron, carbon, and silicon that is cast in a mold and is hard, brittle, nonmalleable, and incapable of being hammer-welded

  E. Low-carbon steel — Steel containing 0.2 percent or less carbon

  F. Mild steel — Steel containing from 0.2 to 0.5 percent carbon

  G. Vanadium — Hardest known metal; used for making very strong alloy steels with manganese or chromium

VII. Types of electrodes

  (NOTE: Electrodes most frequently used are made of mild steel.)

  A. Mild steel

  B. Low-alloy steel

INFORMATION SHEET

C. Nickel steel

D. Chromium/molybdenum steel

E. Manganese/molybdenum steel

F. Nickel/manganese/molybdenum steel

G. Nickel/molybdenum/vanadium steel

H. Aluminum

I. Copper aluminum (aluminum bronze)

J. Lead bronze

K. Phosphor bronze

VIII. Common sizes of electrodes used in arc welding

(NOTE: Electrodes range in size from 1/16 to 5/16 inch.)

A. 3/32 inch

B. 1/8 inch

C. 5/32 inch

D. 3/16 inch

IX. Meanings of numbers in the electrode classification system (Transparency #3)

EXAMPLE: E-6021

A. E — Electric arc welding

B. First two digits (60) — Minimum tensile strength deposited in thousands of pounds per square inch

C. Third digit (2) — Welding position

1. One — Indicates all positions
2. Two — Indicates flat and horizontal only
3. Three — Indicates flat only

INFORMATION SHEET

D. Fourth or last digit (1) — Special characteristics and uses of the electrode

EXAMPLE:

LAST-DIGIT CHARACTERISTICS				
Last Digit	Power Supply	Arc Action	Type of Flux	Penetration Characteristics
0	10, DCRP (+) 20, AC or DC	Digging	10, organic 20, mineral	10, deep 20, medium
1	AC or DCRP (+)	Digging	Organic	Deep
2	AC or DC	Medium	Ductile	Medium
3	AC or DC	Soft	Ductile	Light
4	AC or DC	Soft	Ductile	Light
5	DCRP (+)	Medium	Low hydrogen	Medium
6	AC or DCRP (+)	Medium	Low hydrogen	Medium
7	AC or DC	Soft	Mineral	Medium
8	AC or DCRP (+)	Medium	Low hydrogen	Medium

(Reprinted by permission from T.B. Jefferson, ***The Welding Encylopedia***, p. E-4, Monticello Books, Lake Zurich, Illinois, 1968.)

X. Reverse and straight polarity (Transparency #2)

A. Reverse (+) — Current flows from base metal to electrode

B. Straight (–) — Current flows from electrode to base metal

(NOTE: Welding leads must connect to correct terminals if the machine has a polarity switch. Otherwise, a change in polarity is made by reversing leads on the terminals.)

XI. Factors that determine polarity to use

A. Electrode

B. Type of flux on electrode

(NOTE: Use *Electrode Guidebook* to determine correct polarity for different electrodes.)

EXAMPLES: E-6010 (+) reverse polarity
E-6012 AC-DCSP (–) straight polarity
E-7018 AC-DCRP (+) reverse polarity
E-7024 AC-DCRP-SP (–) reverse or straight polarity

INFORMATION SHEET

XII. Purposes of electrode flux

A. Stabilizing arc

B. Shielding molten puddle from air

C. Floating impurities out of puddle

D. Forming slag and slowing down cooling

E. Increasing welding speed

F. Improving quality of weld

G. Adding alloying elements to weld metal

XIII. Factors to consider when selecting electrodes

A. Plans and specifications

B. Physical and chemical properties of base metal

C. Composition of base metal

D. Thickness and shape of base metal

E. Welding position

F. Welding current

G. Joint design and fit-up

H. Production efficiency and job conditions

XIV. Effects of raising and lowering welding machine amperes

A. Raising amperes — Produces more heat; increases penetration

B. Lowering amperes — Produces less heat; decreases penetration

INFORMATION SHEET

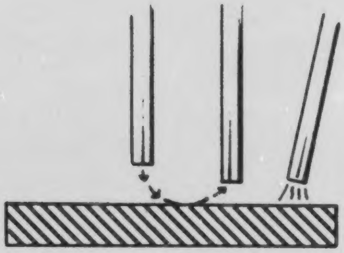
XV. Methods of striking an arc (Figures 1 and 2)

A. Scratching

(NOTE: The scratching method is similar to striking a match.)

EXAMPLE:

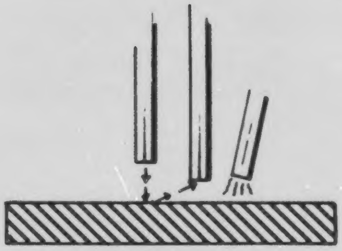
FIGURE 1



B. Tapping

EXAMPLE:

FIGURE 2



XVI. Characteristics of proper arc length

A. End of electrode same distance from base metal as diameter of electrode

EXAMPLE: When using 1/8-inch electrode, arc length should be 1/8 inch.

B. Arc length making steady hum at welder and frying sound at arc

XVII. Parts of the welding process (Transparency #4)

A. Electrode

B. Wire core

C. Coating (flux)

INFORMATION SHEET

D. Arc

E. Gaseous shield

F. Weld

G. Slag

H. Heat lines

I. Base metal

J. Penetration

K. Crater

L. Angle of electrode 15 to 30 degrees

M. Direction of travel

XVIII. Descriptions of types of welds

A. Bead weld — Weld made by one pass of electrode

B. Fillet weld — Weld made in corner or angle formed by two pieces of metal with welded surfaces at approximately 90-degree angles to each other

C. Groove weld — Weld made in groove formed by two beveled pieces of metal

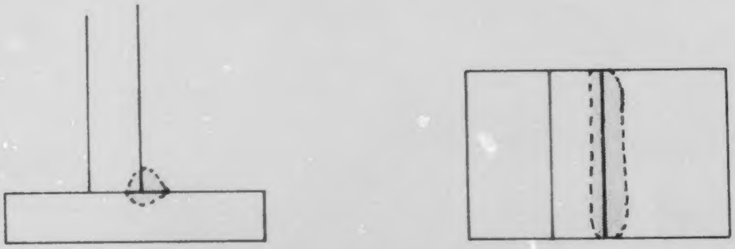
D. Tack weld — Temporary weld made to hold parts in alignment until final welds are made

INFORMATION SHEET

XIX. Types of welds (Figures 3-5)

A. Fillet

FIGURE 3

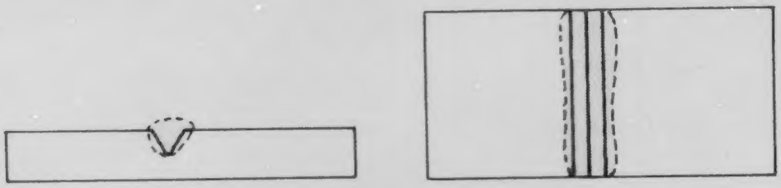


End View

Top View

B. Groove

FIGURE 4

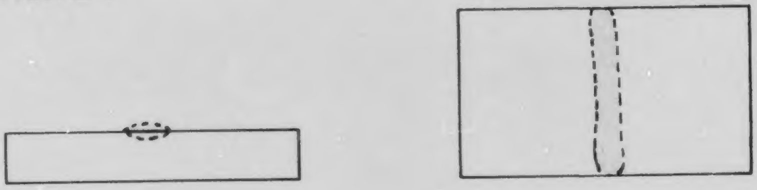


End View

Top View

C. Bead

FIGURE 5



End View

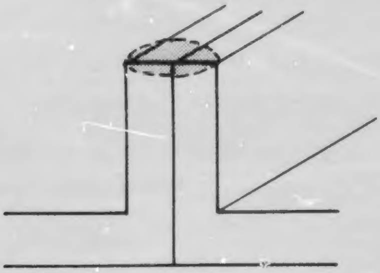
Top View

INFORMATION SHEET

XX. Types of weld joints (Figures 6-10)

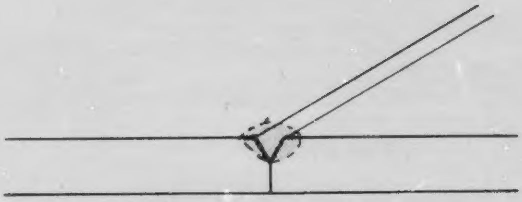
A. Edge

FIGURE 6



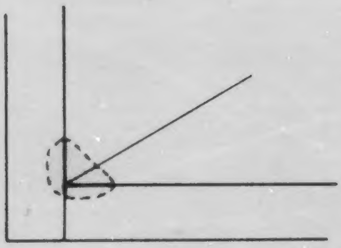
B. Butt

FIGURE 7



C. Corner

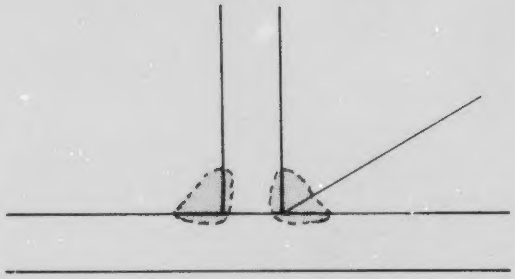
FIGURE 8



INFORMATION SHEET

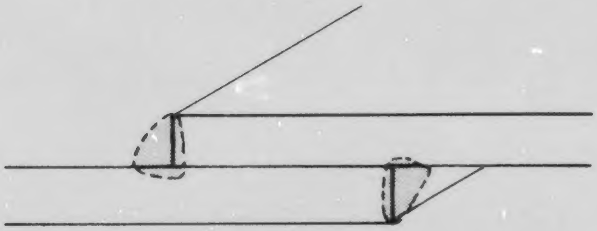
D. T

FIGURE 9



E. Lap

FIGURE 10

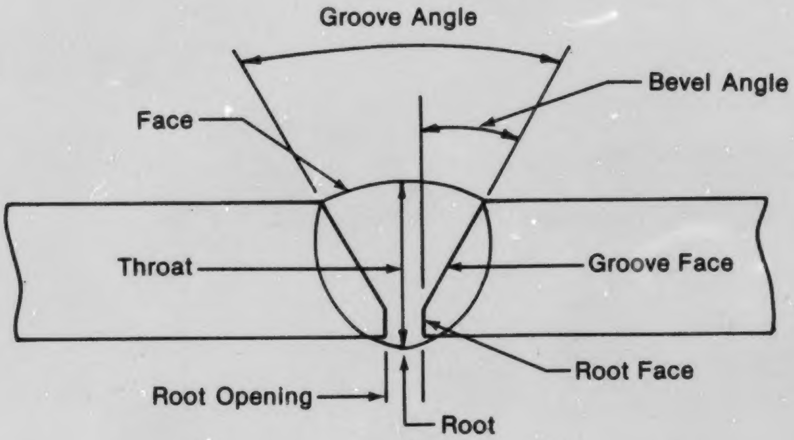


INFORMATION SHEET

XXI. Parts of groove and fillet welds (Figures 11 and 12)

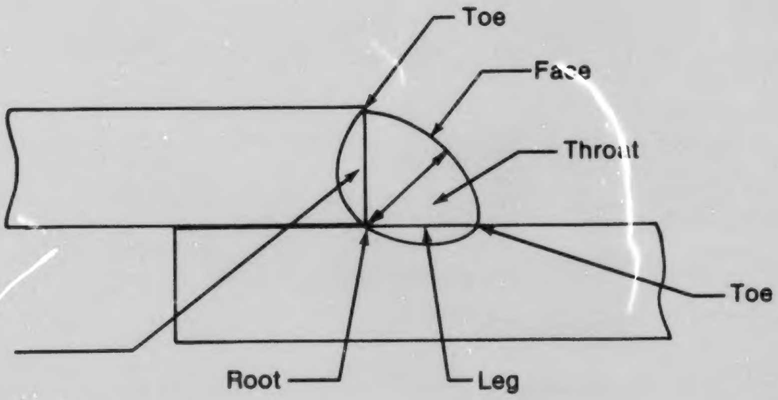
A. Groove weld

FIGURE 11


Groove Angle
Bevel Angle
Face
Throat
Groove Face
Root Face
Root Opening
Root

B. Fillet weld

FIGURE 12


Toe
Face
Throat
Toe
Root
Leg

INFORMATION SHEET

XXII. Positions used in arc welding (Transparency #5)

- A. Flat
- B. Horizontal
- C. Vertical

  (NOTE: In vertical position, the bead may be started either from top or bottom, depending on characteristics of metal and plans and specifications.)

- D. Overhead

XXIII. Reasons for poor welds

- A. Incorrect machine adjustment
- B. Too large or too small electrode
- C. Improper movement of electrode

  (NOTE: You must consider rate of travel and pattern of movement of the electrode.)

- D. Improper angle of electrode
- E. Improper preparation of base metal
- F. Incorrect arc length

XXIV. Types of electrode motions (rod manipulations) (Figures 13-15)

(NOTE: On a single-layer weld, to ensure proper fusion in the root zone, the arc may progress with a straight, forward motion or an oscillating motion, depending on size of joint to be filled.)

- A. Small oscillating motion
- B. Small circular motion
- C. Back-and-forth motion with half circle
- D. Figure-eight motion

INFORMATION SHEET

E. Triangular motion

(NOTE: Most operators use all of these motions, depending upon type of seam, type of joint, size of weld, and position of weld.)

EXAMPLES:

FIGURE 13

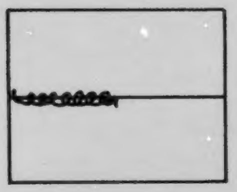


FIGURE 14

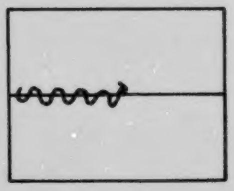
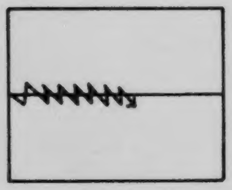


FIGURE 15



XXV. Characteristics of a good weld (Transparency #6)

A. Smooth edges

B. Correct bead size

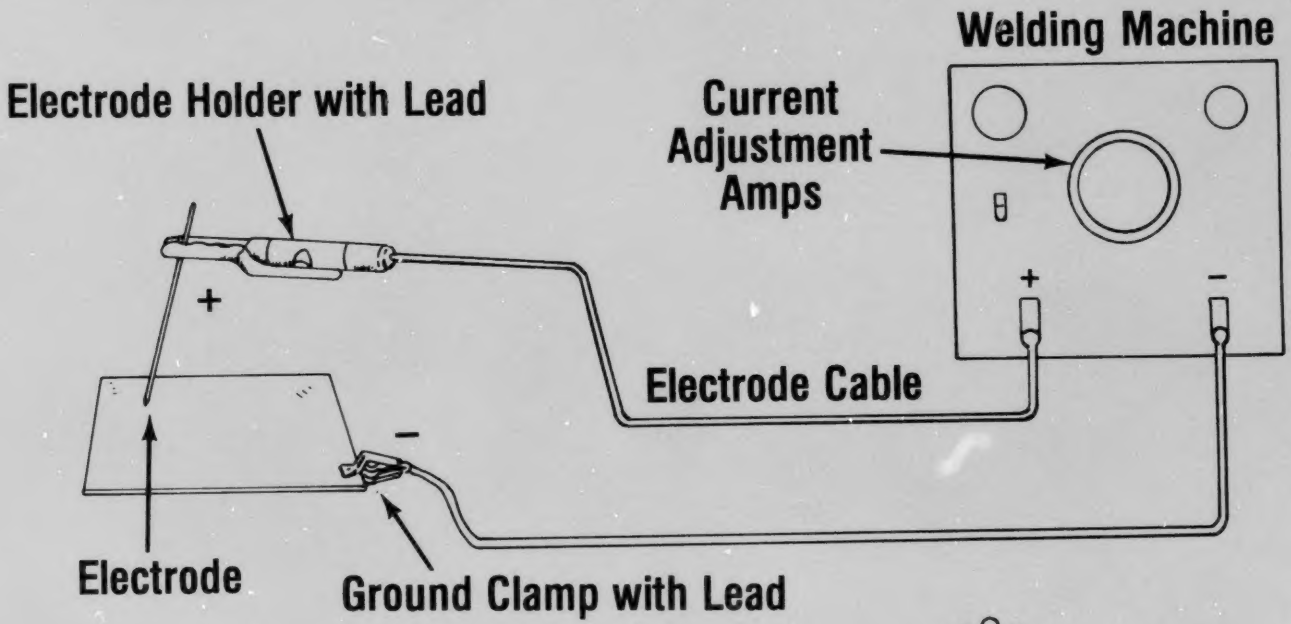
C. Even penetration (well-fused)

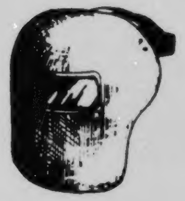
D. Even ripple

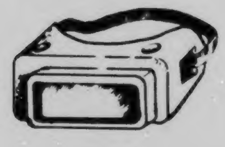
E. Clean, bright weld

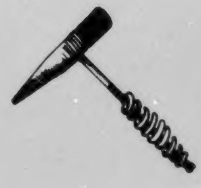
F. Slight crown

Welding Equipment

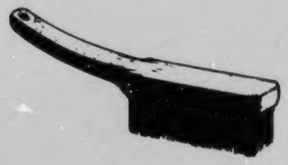

Welding Machine
Electrode Holder with Lead
Current
Adjustment
Amps
+
+
–
Electrode Cable
–
Electrode
Ground Clamp with Lead


Shield or Helmet


Safety Goggles

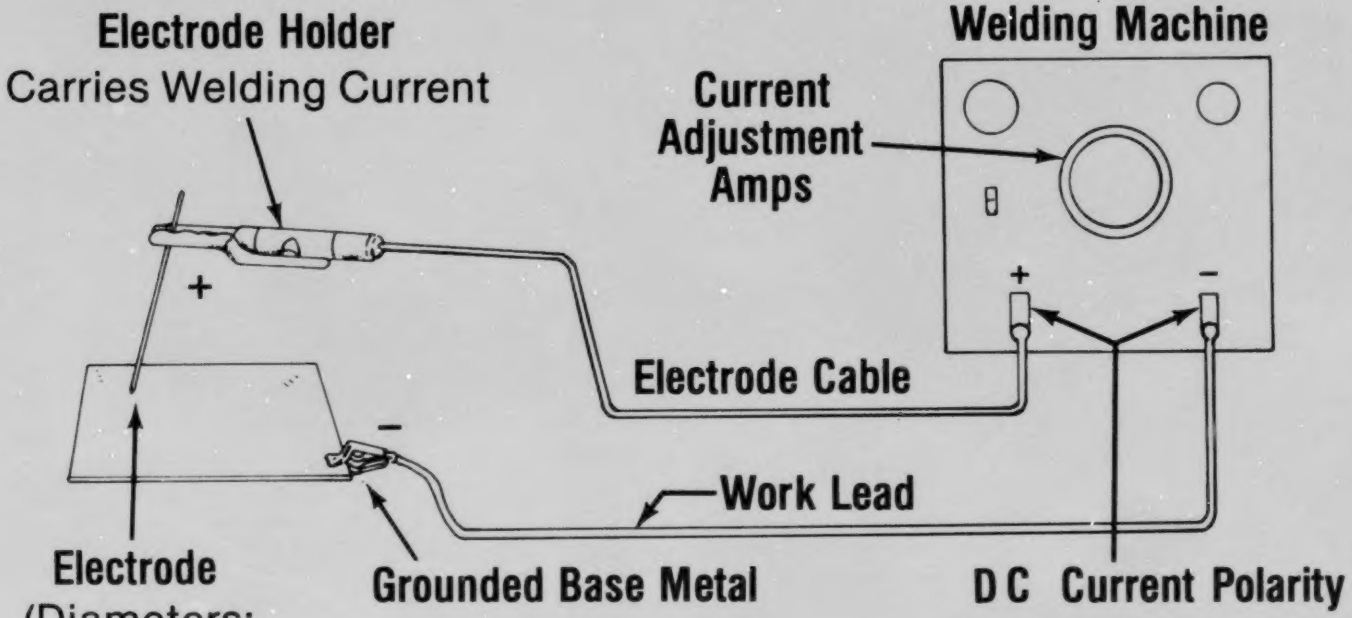

Chipping Hammer

Leather Gloves


Wire Brush

TM #1

Welding Circuit


Electrode Holder
Carries Welding Current
Welding Machine
Current
Adjustment
Amps
+
–
+
–
Electrode Cable
Work Lead
Electrode
Grounded Base Metal
DC Current Polarity

Electrode (Diameters: 1/16″ to 5/16″; 14″ Most Common Length)

Grounded Base Metal (Completes Welding Circuit)

DC Current Polarity

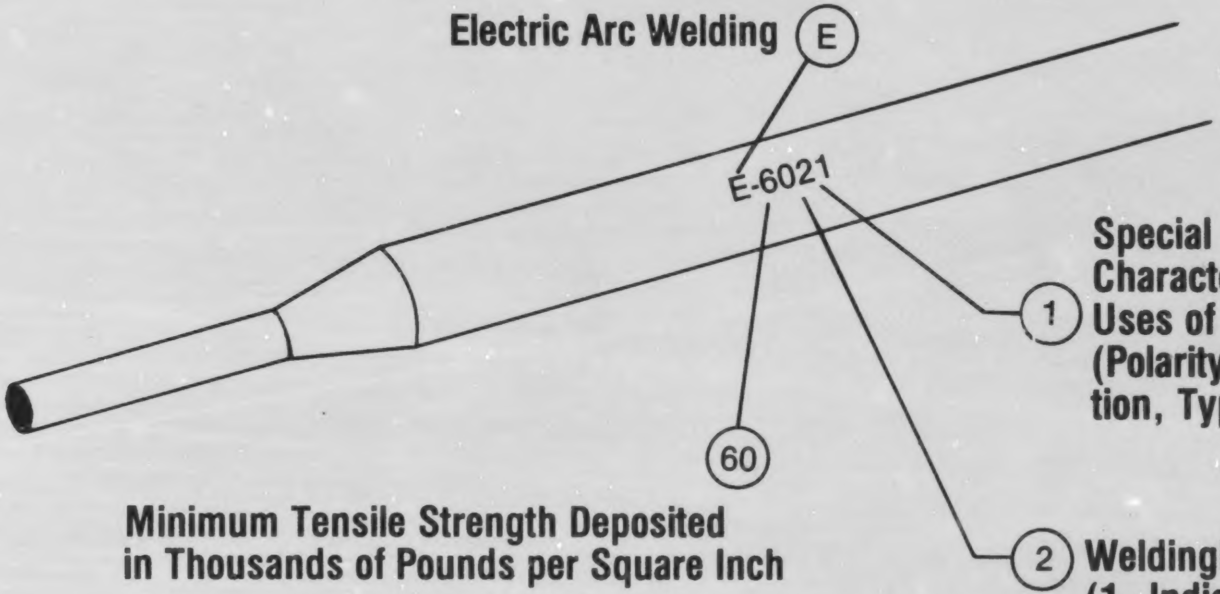
Reverse:

1. Electrode (+)
2. Current flows from base metal to electrode
3. ⅔ heat at (+) electrode
   ⅓ heat at (–) base metal

Straight:

1. Electrode (–)
2. Current flows from electrode to base metal
3. ⅔ heat at (–) base metal
   ⅓ heat at (+) electrode

AWS Classification of Electrodes



Electric Arc Welding

Special Characteristics and Uses of the Electrode (Polarity, Penetration, Type of Welder)

Minimum Tensile Strength Deposited in Thousands of Pounds per Square Inch

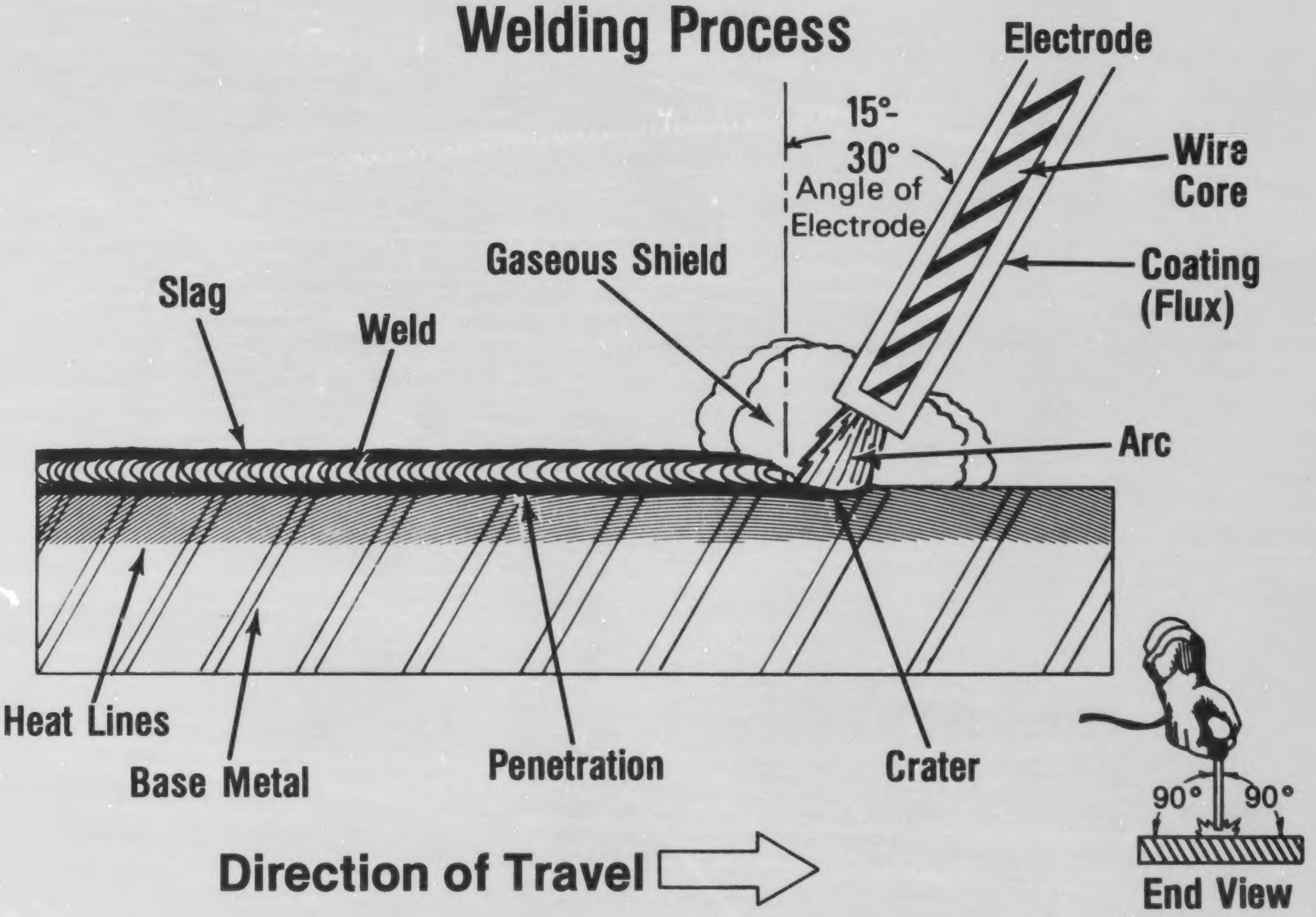
WeldingPosition
(1--Indicates All Positions,
2--Indicates Flat and Horizontal Only,
3--Indicates Flat Only)

E-6021 Mild Steel Electrode

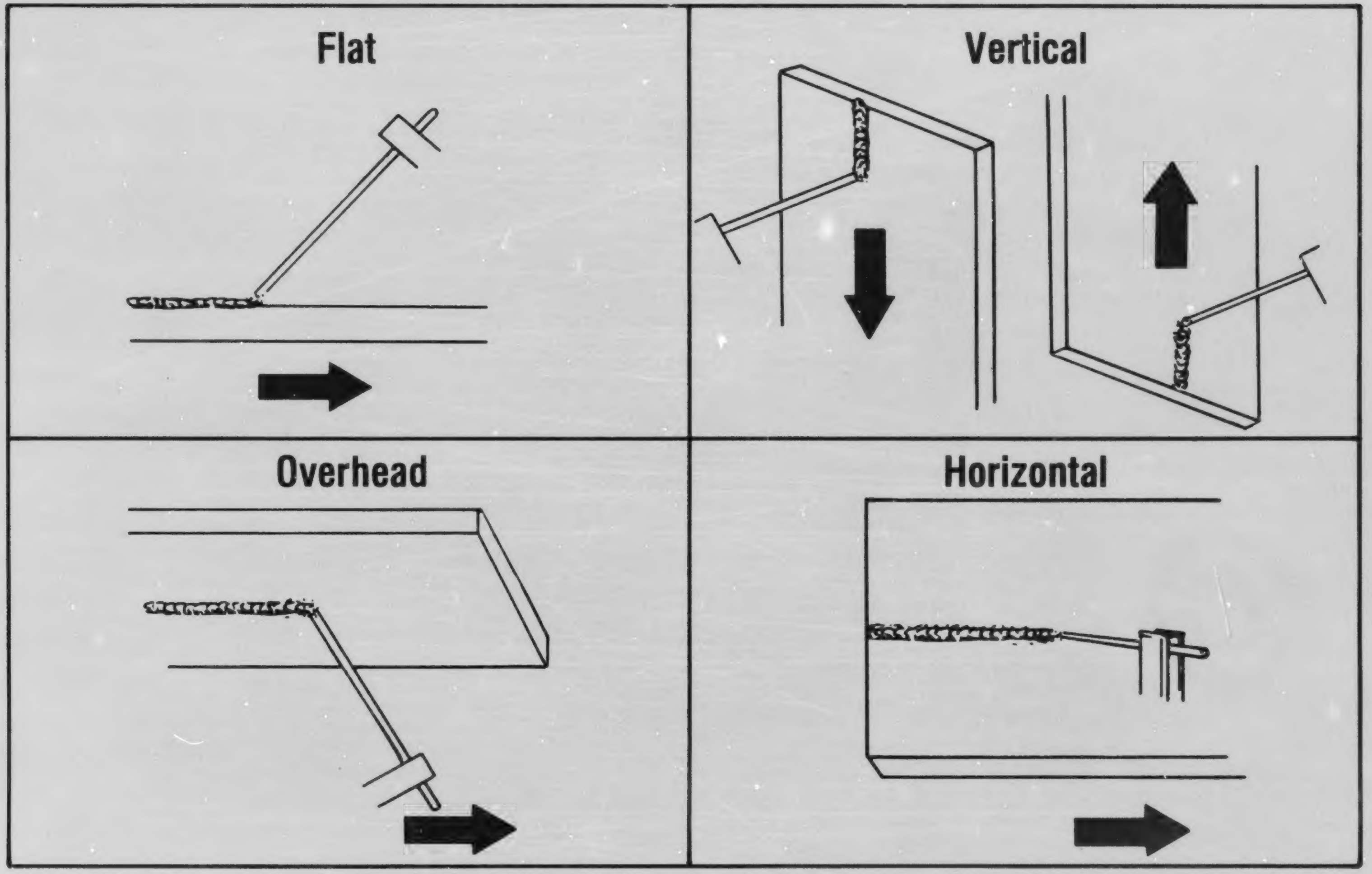
TM #3

BLC - 27-C

Welding Process


Electrode
15°-30° Angle of Electrode
Wire Core
Coating (Flux)
Gaseous Shield
Slag
Weld
Arc
Heat Lines
Base Metal
Penetration
Crater
Direction of Travel
90°
90°
End View

Welding Positions



Flat

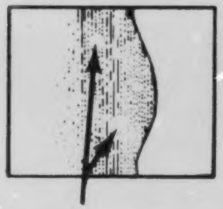
Vertical

Overhead

Horizontal

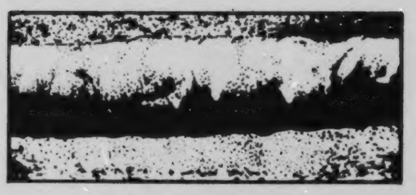
Weld Quality Inspection: Good Welds

End
View



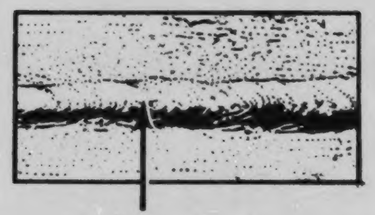
Even Penetration
(Well-Fused)

Top
View



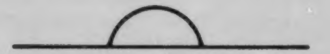
Even Ripple

Top
View



Slight Crown

End
View



Correct Bead Size

ARC WELDING
UNIT I

JOB SHEET #1 — START, STOP, AND RESTART A BEAD

I. Equipment and materials

- A. Piece of metal, 4 inches square, 1/4- to 3/8-inch thick
- B. Welding machine
- C. Electrode holder with lead
- D. Ground clamp with lead
- E. Shield or helmet
- F. Leather gloves
- G. Electrodes
- H. Wire brush
- I. Protective clothing

II. Procedure

- A. Prepare metal for welding
- B. Put on shield or helmet
- C. Strike arc 1 inch from edge where bead is to begin (Figures 16 and 17)

FIGURE 16

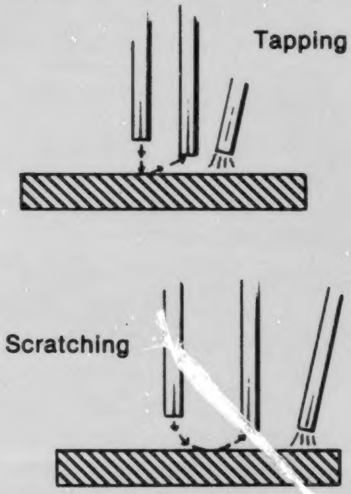
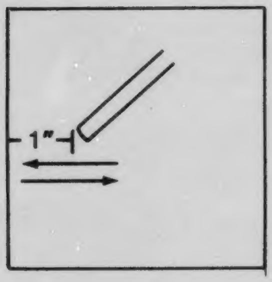


FIGURE 17



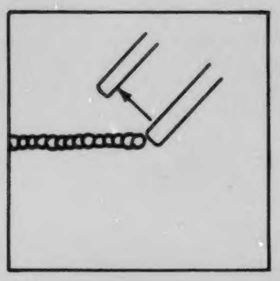
D. When arc burns brightly, move to edge, maintaining correct arc length; begin forming puddle

E. Move across metal 2 inches

F. Move electrode back through puddle, and lift up to stop bead (Figure 18)

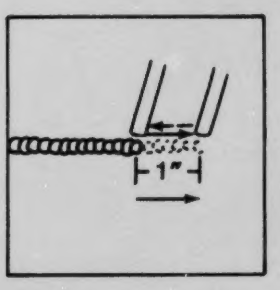
(NOTE: Moving electrode through puddle will prevent cracks from forming in the puddle.)

FIGURE 18



G. Strike arc about 1 inch in front of crater to restart (Figure 19)

FIGURE 19



H. When arc burns brightly, move back through crater, and continue the bead

(NOTE: Moving back through the crater is necessary in order for beads to blend with one another without a change in continuity.)

I. Clean work area; put away all equipment and materials

ARC WELDING
UNIT I

JOB SHEET #2 — CONSTRUCT A PAD WELD

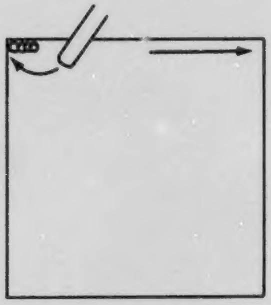
I. Equipment and materials

- A. Piece of metal, 4 inches square, 1/4- to 3/8-inch thick
- B. Welding machine
- C. Electrode holder with lead
- D. Ground clamp with lead
- E. Shield or helmet
- F. Leather gloves
- G. Electrodes
- H. Safety goggles
- I. Chipping hammer
- J. Wire brush
- K. Protective clothing

II. Procedure

- A. Prepare metal for welding
- B. Put on shield or helmet
- C. Strike arc, and move to point to begin pad (Figure 20)

FIGURE 20



- D. Lay a straight bead across the plate using an oscillating motion

  (NOTE: When using an E-6011 electrode, you must manipulate the rod to run a bead. Ask your instructor to explain this process.)

JOB SHEET #2

E. Hold electrode at a 15- to 30-degree angle in direction of travel; to maintain correct arc length, lower electrode as rod burns away (Figure 21)

(NOTE: There should be 90 degrees on each side of the electrode. See Figure 22.)

FIGURE 21

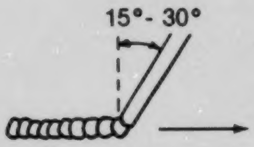
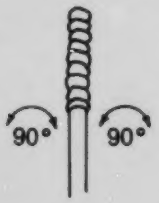


FIGURE 22



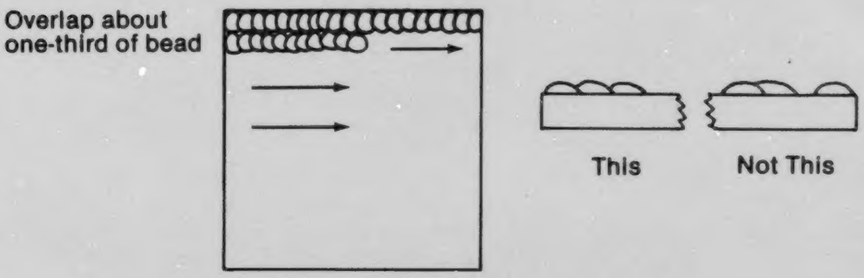
F. Move electrode steadily from left to right across pad

G. Clean slag from each bead before starting next one

(CAUTION: If you remove your shield or helmet, always be sure to put on safety goggles.)

H. Run beads, overlapping each bead until pad is full (Figure 23)

FIGURE 23



I. Before chipping, let each bead cool until slag is black

J. Run additional bead layers until desired thickness is obtained

K. Clean work area; put away all equipment and materials

ARC WELDING
UNIT I

JOB SHEET #3 — CONSTRUCT A BUTT WELD

I. Equipment and materials

A. Two metal pieces 3 by 6 inches, 1/4- to 3/8-inch thick

B. Welding machine

C. Electrode holder with lead

D. Ground clamp with lead

E. Shield or helmet

F. Leather gloves

G. Electrodes

H. Safety goggles

I. Chipping hammer

J. Wire brush

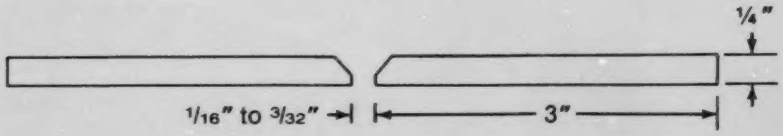
K. Protective clothing

II. Procedure

A. Prepare metal to be welded (Figure 24)

(NOTE: If metal thickness is over 1/8 inch, the edges should be beveled.)

FIGURE 24



B. Place two pieces of metal parallel to each other

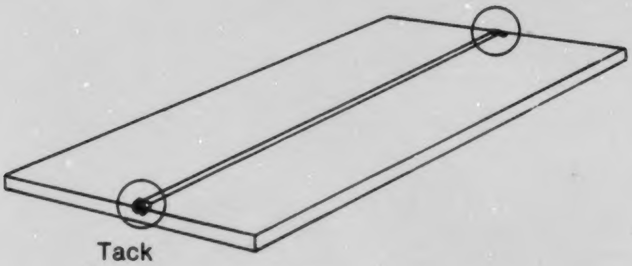
(NOTE: Leave a space of 1/16 to 3/32 inch between them.)

C. Put on shield or helmet

JOB SHEET #3

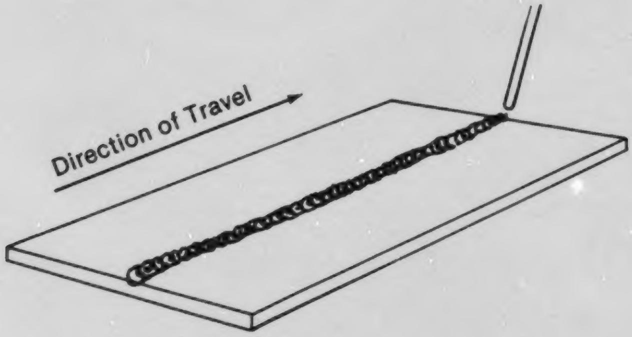
D. Strike an arc, and tack-weld pieces together at both ends (Figure 25)

FIGURE 25



E. Complete weld using a single pass (Figure 26)

FIGURE 26



F. Chip slag; brush the weld

(CAUTION: If you remove your shield or helmet, always be sure to put on safety goggles.)

G. Clean work area; put away all equipment and materials

ARC WELDING
UNIT I

JOB SHEET #4 — CONSTRUCT A LAP-JOINT FILLET WELD IN THE OVERHEAD POSITION

I. Equipment and materials

  A. Arc-welding station and required tools

  B. Two pieces mild steel plate, 2 by 6 inches, 1/4- to 3/8-inch thick

  C. Electrode E-6010, 1/8- or 5/32-inch

    1. 1/8-inch — 75 to 130 amperes

    2. 5/32-inch — 90 to 175 amperes

  D. Current DCRP + at electrode

  E. Chipping hammer

  F. Wire brush

  G. Leather gloves

  H. Shield or helmet

  I. Protective clothing

II. Procedure

  A. Adjust welding machine to correct current and amperage setting

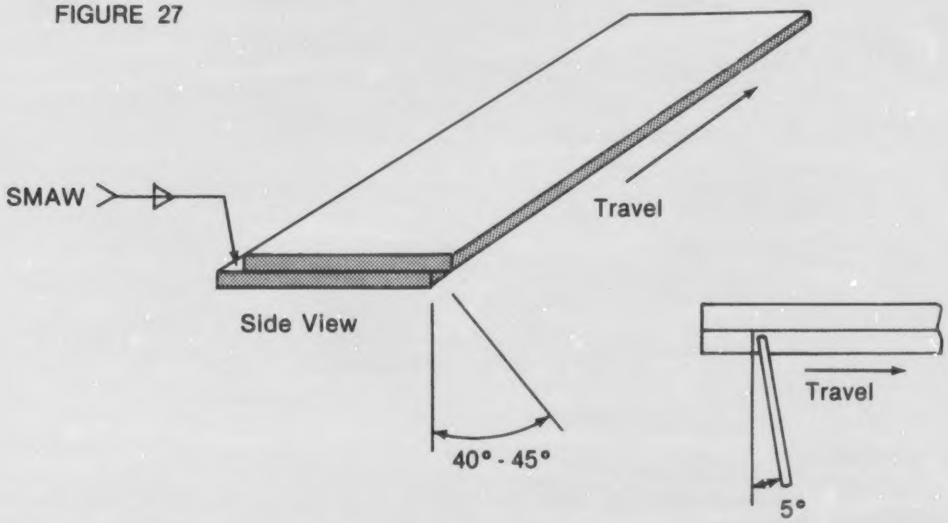
  B. Put on shield or helmet

  C. Prepare metal, and tack plate together for a 90-degree lap joint in the overhead position

JOB SHEET #4

D. Position electrode 40 to 45 degrees out from vertical and inclined 5 degrees in direction of travel (Figure 27)

FIGURE 27



E. Strike arc, and establish a puddle evenly on both pieces

(NOTE: Be sure to get good penetration into root of joint without undercutting or overlapping plates. Some form of whipping motion will be needed.)

F. After depositing first bead (root pass), the weld should be chipped, brushed clean, and checked for bead appearance

G. Deposit additional beads if necessary as stringers or weaves

H. Clean plates

I. Clean work area; put away all equipment and materials

ARC WELDING
UNIT I

JOB SHEET #5 — CONSTRUCT A T-JOINT FILLET WELD IN THE VERTICAL UP POSITION

I. Equipment and materials

   A. Arc-welding station and required tools

   B. Two pieces mild steel plate, 2 by 6 inches, 1/4- to 3/8-inch thick

   C. Electrode E-6010, 1/8- or 5/32-inch

      1. 1/8-inch — 75 to 130 amperes

      2. 5/32-inch — 90 to 175 amperes

   D. Current DCRP + at electrode

   E. Chipping hammer

   F. Wire brush

   G. Leather gloves

   H. Shield or helmet

   I. Protective clothing

II. Procedure

   A. Adjust welding machine to correct current and amperage setting

   B. Put on shield or helmet

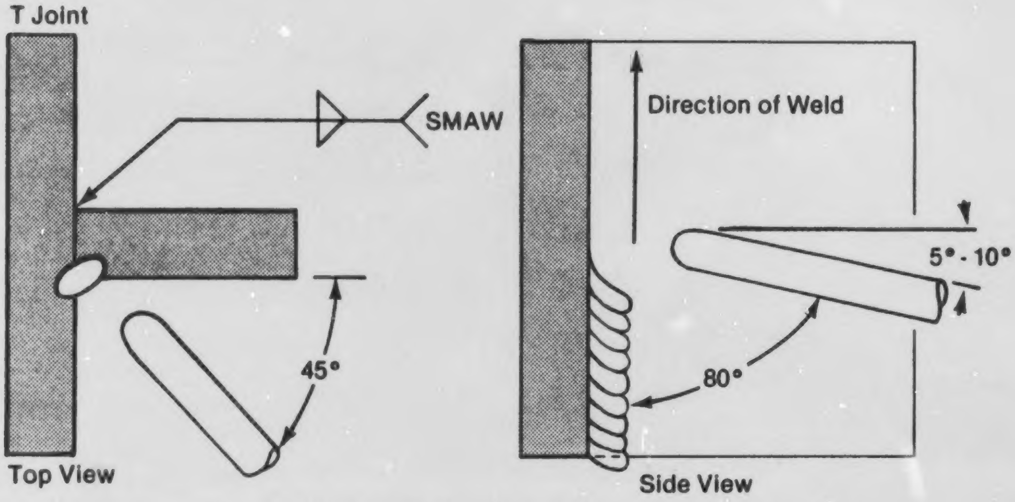
   C. Prepare metal, and tack in vertical position; remove slag

   D. Strike arc at bottom of joint; hold a high arc length for one to two seconds to heat plates

JOB SHEET #5

E. Position electrode in middle of joint, making a 45-degree angle with each plate and holding electrode 5 to 10 degrees down from horizontal (Figure 28)

FIGURE 28



Electrode Position of Vertical Up T Joint

F. Deposit weld upward using some form of up and down whipping motion

(NOTE: Bead uniformity depends upon proper timing and manipulation of electrode. Check with instructor for correct procedures.)

G. Remove slag and clean thoroughly after each pass

H. Alternate sides to minimize distortion

(NOTE: Check with instructor at this point. Upon receiving instructor's approval, additional beads may be stringers or some form of weave bead.)

I. Clean work area; put away all equipment and materials

ARC WELDING
UNIT I

JOB SHEET #6 — CONSTRUCT A SQUARE-GROOVE BUTT-JOINT WELD IN THE VERTICAL DOWN POSITION

I. Equipment and materials

   A. Arc-welding station and required tools

   B. Two pieces mild steel plate, 3 by 6 inches, 1/8- to 3/16-inch thick

   C. Electrode E-6010, 1/8- or 5/32-inch

      1. 1/8-inch — 75 to 130 amperes

      2. 5/32-inch — 90 to 175 amperes

   D. Current DCRP + at electrode

   E. Chipping hammer

   F. Wire brush

   G. Leather gloves

   H. Shield or helmet

   I. Protective clothing

II. Procedure

   A. Adjust welding machine to correct current and amperage setting

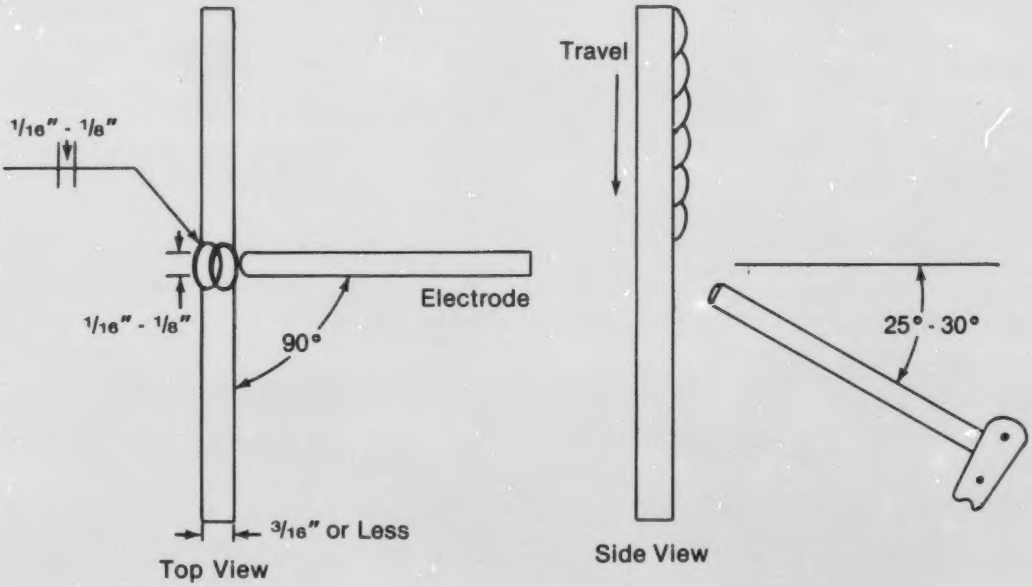
   B. Put on shield or helmet

   C. Prepare metal and tack, leaving a 1/16- to 1/8-inch root gap in vertical position

JOB SHEET #6

D. Position electrode in middle of joint and down 25 to 30 degrees from horizontal (Figure 29)

FIGURE 29


1/16" - 1/8"
1/16" - 1/8"
90°
Electrode
3/16" or Less
Top View
Travel
25° - 30°
Side View

E. Strike arc at top of plates; hold a high arc length for one to two seconds to heat plates and prevent cold laps

F. Weld down, holding a short arc length and using some form of whipping motion

G. Remove all slag from face and root; inspect bead thoroughly for penetration and even fusion with both plates

H. Start at top of reverse side and run second bead using same technique as in first pass

I. Clean work area; put away all equipment and materials

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ARC WELDING
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with arc welding to their correct definitions. Write the correct numbers in the blanks. Terms and definitions are continued on the next page.

______a. Flow of current across a narrow gap, usually from tip of electrode to base metal

______b. Process of heating metal to a molten state and allowing it to cool

______c. Joining of two or more pieces of metal by fusion process

______d. Depression at termination of weld

______e. Single longitudinal progression of a welding operation along a joint or weld deposit

______f. Metal rod that conducts a current from electrode holder to base metal

______g. Angular cut made on the vertical edge of base metal to allow better weld penetration

______h. Weld between two metal joints on the same plane

______i. Portion of a weld that is molten at the place heat is applied

______j. Metal center of electrode

______k. Cables leading from ground clamp and holder to machine

______l. Coating on outside of electrode; chemical used to promote fusion during welding process

______m. Gas given off by melting of electrode flux

1. Arc welding
2. Bevel
3. Puddle
4. Crater
5. Wire core
6. Arc
7. Pass
8. Butt joint
9. Fusion process
10. Electrode
11. Flux
12. Lead
13. Gaseous shield

TEST

______ n. Nonmetallic porous material trapped in weld metal or between weld metal and base metal

______ o. That part of base metal altered by heat from welding, brazing, or cutting operations

______ p. Distance from original surface of base metal to that point at which fusion ceases

______ q. Electrode with low hydrogen content; used when cracking is a potential problem

______ r. Capable of being drawn or stretched

______ s. Distance from end of electrode to point where arc makes contact with work surface

______ t. Lightly ruffled or covered with small waves

______ u. Capable of being worked into a different shape or form

______ v. Condition of being positive (+) or negative (−), as the ends of a magnet or electrical mechanism

14. Heat line (heat-affected zone)
15. Penetration
16. Low-hydrogen electrode
17. Slag inclusion
18. Rippled
19. Malleable
20. Arc length
21. Ductile
22. Polarity

2. Write meanings of abbreviations associated with arc welding.

a. AC—____

____

b. AWS—____

____

c. DC—____

____

d. OSHA—____

____

e. psi—____

____

TEST

3. State ten safety precautions to observe when welding.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

4. Name types of arc-welding machines.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

5. Select from the following list common tools and equipment used in arc welding. Write an "X" in the blank before each correct answer.

______a. Shield or helmet

______b. Safety goggles

______c. Electrode

______d. Oxyacetylene tank

______e. Ground clamp with lead

______f. Welding machine

TEST

______g. Wire brush

______h. Electrode holder with lead

______i. Leather gloves

______j. Chipping hammer

______k. Protective clothing

6. Match to their correct definitions terms associated with welding materials. Write the correct numbers in the blanks.

______a. Steel containing from 0.2 to 0.5 percent carbon

______b. Metal to be cut or welded

______c. Steel containing 0.2 percent or less carbon

______d. Hardest known metal; used for making very strong alloy steels with manganese or chromium

______e. Commercial alloy of iron, carbon, and silicon that is cast in a mold and is hard, brittle, nonmalleable, and incapable of being hammer-welded

______f. Bluish, silver-white, malleable, ductile, light, trivalent metallic element

______g. Mixture of two or more elements, of which at least one is a metal

1. Alloy
2. Aluminum
3. Base metal
4. Cast iron
5. Low-carbon steel
6. Mild steel
7. Vanadium

7. List three types of electrodes.

a. ______________________________

b. ______________________________

c. ______________________________

8. Select from the following list common sizes of electrodes used in arc welding. Write an "X" in blank before each correct answer.

______a. $^{3}/_{32}$ inch

______b. $^{1}/_{8}$ inch

TEST

_____c. $^1/_4$ inch

_____d. $^5/_{16}$ inch

_____e. $^5/_{32}$ inch

_____f. $^3/_{16}$ inch

9. Interpret meanings of numbers in the electrode classification system.

EXAMPLE: E-6021

a. E — ____________________

b. First two digits — ____________________

____

c. Third digit — ____________________

1) ____________________

2) ____________________

3) ____________________

d. Fourth or last digit — ____________________

____

10. Distinguish between reverse and straight polarity. Write an "X" in the blank before the statement that represents reverse polarity.

_____a. Current flows from electrode to base metal

_____b. Current flows from base metal to electrode

11. Select from the following list factors that determine correct polarity to use. Write an "X" in the blank before each correct answer.

_____a. Electrode

_____b. Current

_____c. Type of flux on electrode

_____d. Color of electrode

_____e. Brand of electrode

TEST

12. Select from the following list purposes of electrode flux. Write an "X" in the blank before each correct answer.

_____a. Floating impurities out of puddle

_____b. Protecting electrode

_____c. Forming slag and slowing down cooling

_____d. Increasing welding speed

_____e. Shielding electrode from air

_____f. Stabilizing arc

_____g. Adding slag elements to weld metal

_____h. Improving quality of weld

13. List five factors to consider when selecting electrodes.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

14. Describe effects of raising and lowering welding machine amperes.

a. Raising amperes — ______________________________

____

b. Lowering amperes — ______________________________

____

15. Name methods of striking an arc.

a. ______________________________

b. ______________________________

TEST

16. Select from the following list characteristics of proper arc length. Write an "X" in the blank before each correct answer.

_____a. Arc length same size as bead

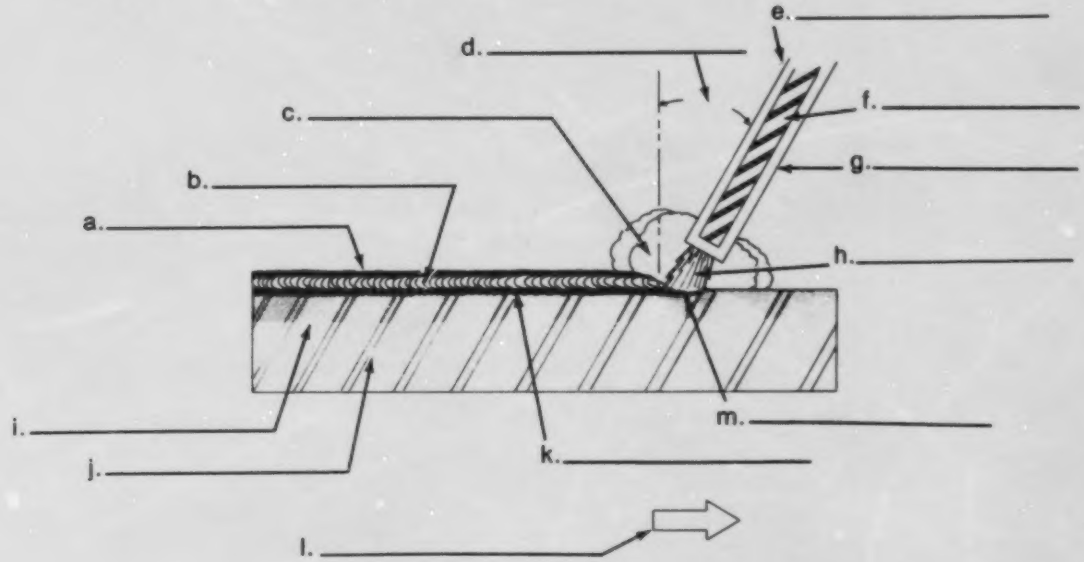
_____b. Arc length making steady hum at welder and frying sound at arc

_____c. End of electrode same distance from base metal as diameter of electrode

_____d. End of electrode touching base metal

17. Identify parts of the welding process illustrated below. Write the correct names in the blanks.

Electrode
Coating (flux)
Penetration
Slag
Wire core
Arc
Weld
Direction of travel
Angle of electrode 15 to 30 degrees
Heat lines
Gaseous shield
Base metal
Crater



TEST

18. Match types of welds to their correct descriptions. Write the correct numbers in the blanks.

_____a. Weld made by one pass of electrode

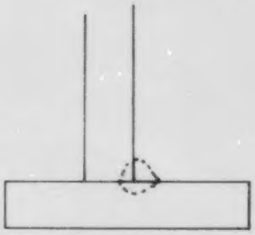
_____b. Temporary weld made to hold parts in alignment until final welds are made

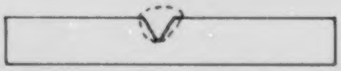
_____c. Weld made in groove formed by two beveled pieces of metal

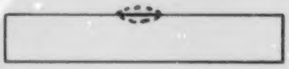
_____d. Weld made in corner or angle formed by two pieces of metal with welded surfaces at approximately 90-degree angles to each other

1. Tack weld
2. Bead weld
3. Fillet weld
4. Groove weld

19. Label types of welds illustrated below.

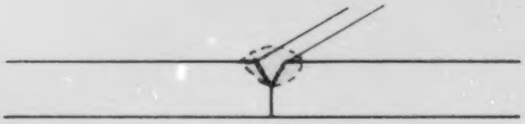


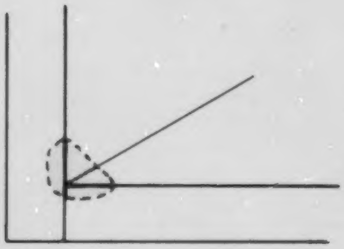




a. ____________________ b. ____________________ c. ____________________

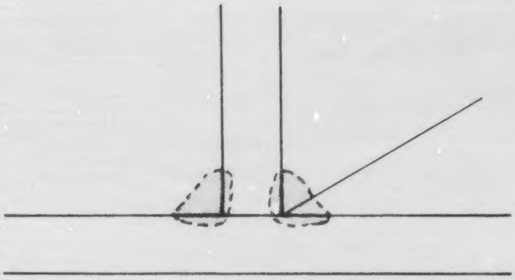
20. Label types of weld joints illustrated below and on the following page.



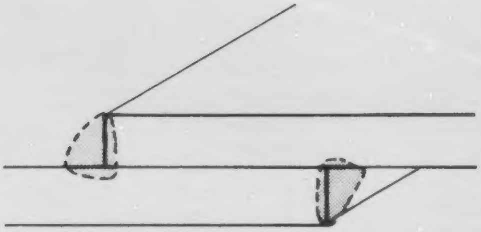


a. ______________________________ b. ______________________________

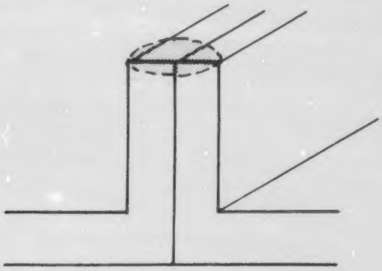
TEST



c. ______________________________



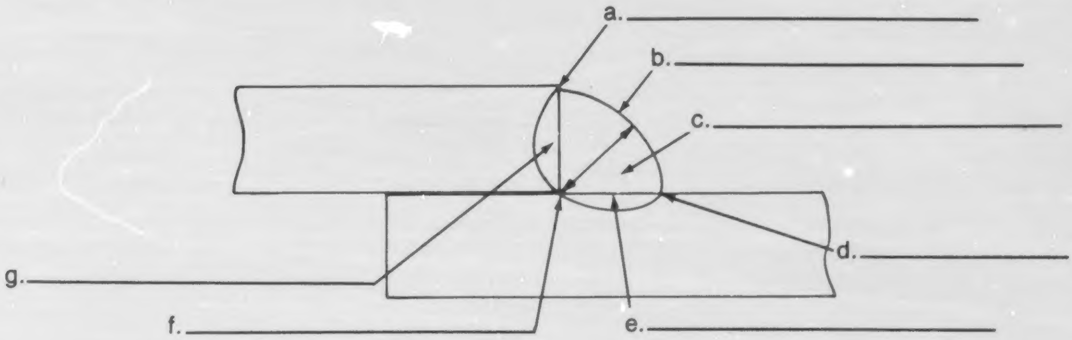
d. ______________________________



e. ______________________________

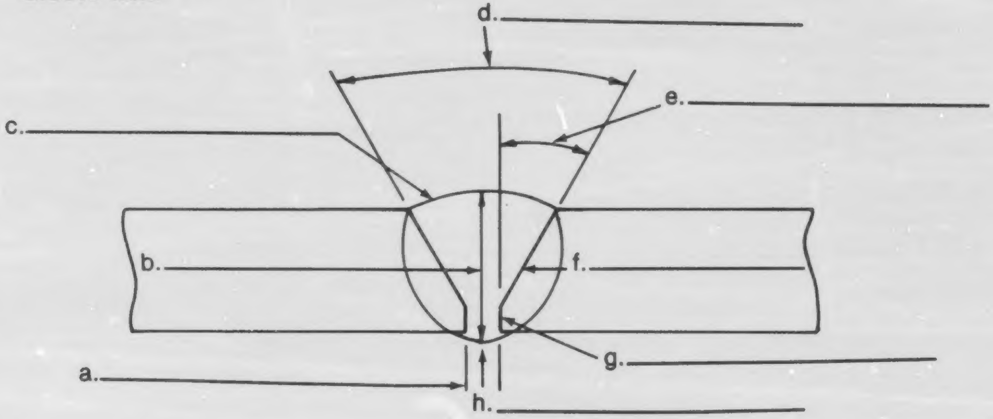
21. Label parts of groove and fillet welds illustrated below and on the following page.

Fillet weld



TEST

Groove weld



22. List positions used in arc welding.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

23. List three reasons for poor welds.

a. ______________________________

b. ______________________________

c. ______________________________

24. List four types of electrode motions (rod manipulations).

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

TEST

25. State three characteristics of a good weld.

a. ______________________________

b. ______________________________

c. ______________________________

(NOTE: Test question 26 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

26. Demonstrate the ability to

a. Start, stop, and restart a bead.

b. Construct a pad weld.

c. Construct a butt weld.

d. Construct a lap-joint fillet weld in the overhead position.

e. Construct a T-joint weld in the vertical up position.

f. Construct a square-groove butt-joint weld in the vertical down position.

BLC - 59-C

ARC WELDING
UNIT I

ANSWERS TO TEST

1.

a.	6	g.	2	m.	13	s.	20
b.	9	h.	8	n.	17	t.	18
c.	1	i.	3	o.	14	u.	19
d.	4	j.	5	p.	15	v.	22
e.	7	k.	12	q.	16		
f.	10	l.	11	r.	21		

2. a. AC — Alternating current; electric current that reverses its direction at regular intervals

   b. AWS — American Welding Society

   c. DC — Direct current; electric current flowing in one direction only and mostly constant in value

   d. OSHA — Occupational Safety and Health Act

   e. psi — Pounds per square inch

3. Answer should include any ten of the following

   a. Do not look at arc or reflection without eye protection

   b. Do not wear a shield or helmet that is in bad condition

   c. Do not chip slag without wearing safety goggles

   d. Wear proper protective clothing

   e. Do not strike an arc until you have taken all safety precautions

   f. Do not weld around combustible or flammable materials

   g. Do not pick up hot metals with bare hands

   h. Be sure that confined areas are properly ventilated

   i. Disconnect plug before checking welding machine

ANSWERS TO TEST

j. Do not leave electrode holder on welding table or in direct contact with grounded metal

k. Do not use worn or frayed cables

l. Be sure that floor is dry; do not stand in water when welding

m. Keep work area clean

n. Keep tools and materials in proper locations

o. Dispose of electrode stubs properly

4. a. Alternating-current (AC) transformer welder

   b. Direct-current (DC) welder

   c. Motor generator

   d. Engine generator

   e. AC/DC transformer rectifier

5. a, b, c, e, f, g, h, i, j, k

6. a. 6

   b. 3

   c. 5

   d. 7

   e. 4

   f. 2

   g. 1

7. Answer should include any three of the following

   a. Mild steel

   b. Low-alloy steel

   c. Nickel steel

   d. Chromium/molybdenum steel

   e. Manganese/molybdenum steel

   f. Nickel/manganese/molybdenum steel

   g. Nickel/molybdenum/vanadium steel

   h. Aluminum

   i. Copper aluminum (aluminum bronze)

   j. Lead bronze

   k. Phosphor bronze

ANSWERS TO TEST

8. a, b, e, f

9. a. E — Electric arc welding

   b. First two digits — Minimum tensile strength deposited in thousands of pounds per square inch

   c. Third digit — Welding position

      1) One — Indicates all positions

      2) Two — Indicates flat and horizontal only

      3) Three — Indicates flat only

   d. Fourth or last digit — Special characteristics and uses of the electrode

10. b

11. a, c

12. a, c, d, f, h

13. Answer should include any five of the following

   a. Plans and specifications

   b. Physical and chemical properties of base metal

   c. Composition of base metal

   d. Thickness and shape of base metal

   e. Welding position

   f. Welding current

   g. Joint design and fit-up

   h. Production efficiency and job conditions

ANSWERS TO TEST

14. a. Produces more heat; increases penetration
    b. Produces less heat; decreases penetration

15. a. Scratching
    b. Tapping

16. b, c

17. a. Slag
    b. Weld
    c. Gaseous shield
    d. Angle of electrode 15 to 30 degrees
    e. Electrode
    f. Wire core
    g. Coating (flux)
    h. Arc
    i. Heat lines
    j. Base metal
    k. Penetration
    l. Direction of travel
    m. Crater

18. a. 2
    b. 1
    c. 4
    d. 3

19. a. Fillet
    b. Groove
    c. Bead

20. a. Butt
    b. Corner
    c. T
    d. Lap
    e. Edge

ANSWERS TO TEST

21.

	Fillet weld		**Groove weld**
a.	Toe	a.	Root opening
b.	Face	b.	Throat
c.	Throat	c.	Face
d.	Toe	d.	Groove angle
e.	Leg	e.	Bevel angle
f.	Root	f.	Groove face
g.	Leg	g.	Root face
		h.	Root

22. a. Flat
    b. Horizontal
    c. Vertical
    d. Overhead

23. Answer should include any three of the following
    a. Incorrect machine adjustment
    b. Too large or too small electrode
    c. Improper movement of electrode
    d. Improper angle of electrode
    e. Improper preparation of base metal
    f. Incorrect arc length

24. Answer should include any four of the following
    a. Small oscillating motion
    b. Small circular motion

ANSWERS TO TEST

c. Back-and-forth motion with half circle
d. Figure-eight motion
e. Triangular motion

25. Answer should include any three of the following
    a. Smooth edges
    b. Correct bead size
    c. Even penetration (well-fused)
    d. Even ripple
    e. Clean, bright weld
    f. Slight crown

26. Performance skills evaluated to the satisfaction of the instructor

OXYACETYLENE CUTTING
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to set up, light, adjust, and use an oxyacetylene cutting outfit. The student will show this knowledge by completing job sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with oxyacetylene cutting to their correct definitions.
2. State color codes for oxygen and acetylene.
3. Arrange in order stages in the oxyacetylene cutting process.
4. Identify the parts of an oxyacetylene cutting outfit.
5. Identify the parts of a torch body and cutting attachment.
6. State safety rules for working with oxyacetylene equipment.
7. Identify types of oxyacetylene cutting flames.
8. Distinguish between flashback and backfire.
9. Arrange in order steps to follow in case of flashback.
10. Select from a list causes of backfire.
11. Match common cutting-torch tips to their correct uses.
12. Identify a multiflame heating nozzle (rosebud) and tip.
13. Describe uses of a multiflame heating nozzle (rosebud).
14. Demonstrate the ability to
    a. Set up equipment for oxyacetylene cutting.
    b. Turn on, light, adjust to a neutral flame, and turn off oxyacetylene cutting equipment.
    c. Cut mild steel at a 90-degree angle, stop, and restart the cut.
    d. Cut round stock.

OXYACETYLENE CUTTING
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit.

      1. Films

         a. *Flame Cutting.* Color, 20 minutes, MacMillian Films, 1972. Available from MacMillian Films, 34 MacQuesten Parkway South, Mount Vernon, New York 10550, 914/664-5051.

         (NOTE: This film provides step-by-step instructions for making straight-line cuts, cutting irregular shapes, beveling plate edges, and making circle cuts. It gives excellent instructions on freehand cutting and oxyacetylene cutting torch.)

         b. *The Cutting Torch — Flame Cutting.* Color, 18 minutes, BFA Educational Media, 1972. Available from BFA Educational Media, 468 Park Avenue South, New York, New York 10016, 212/684-5910.

         (NOTE: This film covers the many aspects of tip selection and the procedures for using the torch.)

         c. *Don't Push Your Luck.* Color, 12 minutes, Harvest Films, 1978. Available from Harvest Films, Inc., 309 5th Avenue, New York, New York 10016, 212/648-7950.

         (NOTE: Bill Frank, the actual victim, recreates his real-life blinding accident. He delivers to employees a powerful safety message on face and eye protection.)

      2. Slide/cassette programs

         a. *There's Something in the Air.* Thirty slides with cassette, National Safety Council, n.d. Available from National Safety Council, P.O. Box 11933, Chicago, Illinois 60611, 312/527-4800.

         (NOTE: This program tells workers how to protect themselves from contaminated air — fogs, mists, fumes, gases, smokes, sprays, and vapors — that could be harmful to their lungs.)

SUGGESTED ACTIVITIES

b. *Oxyacetylene Cutting Explained.* Two color filmstrips, 2 cassettes, 12 to 13 minutes each, Bergwall Productions, Inc., n.d. May be purchased from Bergwall Productions, 839 Steward Avenue, P.O. Box 238, Garden City, New York 11530. Call toll-free 800/645-3565.

(NOTE: Part 1, *Setting Up Equipment,* explains cutting operation: cutting tip, attaching tip to torch body, lighting and testing flame, purging the line and shutting down the unit. Part 2, *Specialized Oxyacetylene Cutting,* demonstrates torch angle, correct cutting procedure, lighting and testing the flame, cutting thin and heavy stock, chamfering, constructing and using guide for cutting a circle, and piercing stock.)

B. Obtain transparencies.

(NOTE: Transparencies are available from AGC and CIMC.)

C. Gather equipment and materials for job sheet demonstrations.

D. Get color flame charts from welding supplier to show types of flames.

E. Contact local welding supplier for materials on cutting techniques, pressurized gas, safety equipment, and other items of interest.

F. Provide students with objective sheet.

G. Discuss unit and specific objectives.

H. Provide students with information and job sheets.

I. Discuss information sheet.

J. Review first aid for burns.

K. Arrange a field trip for students to observe flame cutting equipment and operations.

L. Demonstrate and discuss procedures outlined in job sheets.

M. Provide alternate jobs if those in job sheets are not practical.

N. Have students demonstrate the ability to use equipment safely and according to the recommended uses.

O. Give test.

P. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

SUGGESTED ACTIVITIES

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Transparency masters

      1. TM #1 — Oxygen Regulator Gauges

      2. TM #2 — Acetylene Regulator Gauges

   E. Job sheets

      1. Job Sheet #1 — Set Up Equipment for Oxyacetylene Cutting

      2. Job Sheet #2 — Turn On, Light, Adjust to a Neutral Flame, and Turn Off Oxyacetylene Cutting Equipment

      3. Job Sheet #3 — Cut Mild Steel at a 90-Degree Angle, Stop, and Restart the Cut

      4. Job Sheet #4 — Cut Round Stock

   F. Test

   G. Answers to test

III. Unit references

   A. Althouse, Andrew P., Carl H. Turnquist, and William A. Bowditch. *Modern Welding.* Homewood, Illinois: Goodheart-Willcox Company, 1965.

   B. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator Instructional Materials*, Vol. I. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1981.

   C. Hendrix, Laborn J., "Bud." *Millwright Instructional Materials*, Vol. I. Stillwater, Oklahoma: State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center, and Associated General Contractors of America, 1980.

OXYACETYLENE CUTTING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Acetylene — Colorless, gaseous hydrocarbon used in cutting and welding

(NOTE: Other gases are also used in cutting.)

B. Combustible — Capable of burning

C. Flint lighter — Striker used to ignite torch

D. Journal — That part of a shaft, axle, or spindle that turns in a bearing

E. Oxyacetylene cutting — Flame cutting of metal in which the preheating of the metal is accomplished with a flame produced by an oxyacetylene torch

F. Oxygen — Element that is normally a colorless, odorless, and tasteless gas; used in combination with other substances in cutting and welding

G. psi — Pounds per square inch

H. Purge — To remove any foreign material from a system or component by flushing with the gas used in that system

I. Slag — Metal that melts away during the oxyacetylene cutting process

J. Slag box — Metal container with a layer of water or sand to catch hot material

K. Toxic — Poisonous

II. Color codes for oxygen and acetylene

A. Oxygen — Green

B. Acetylene — Red

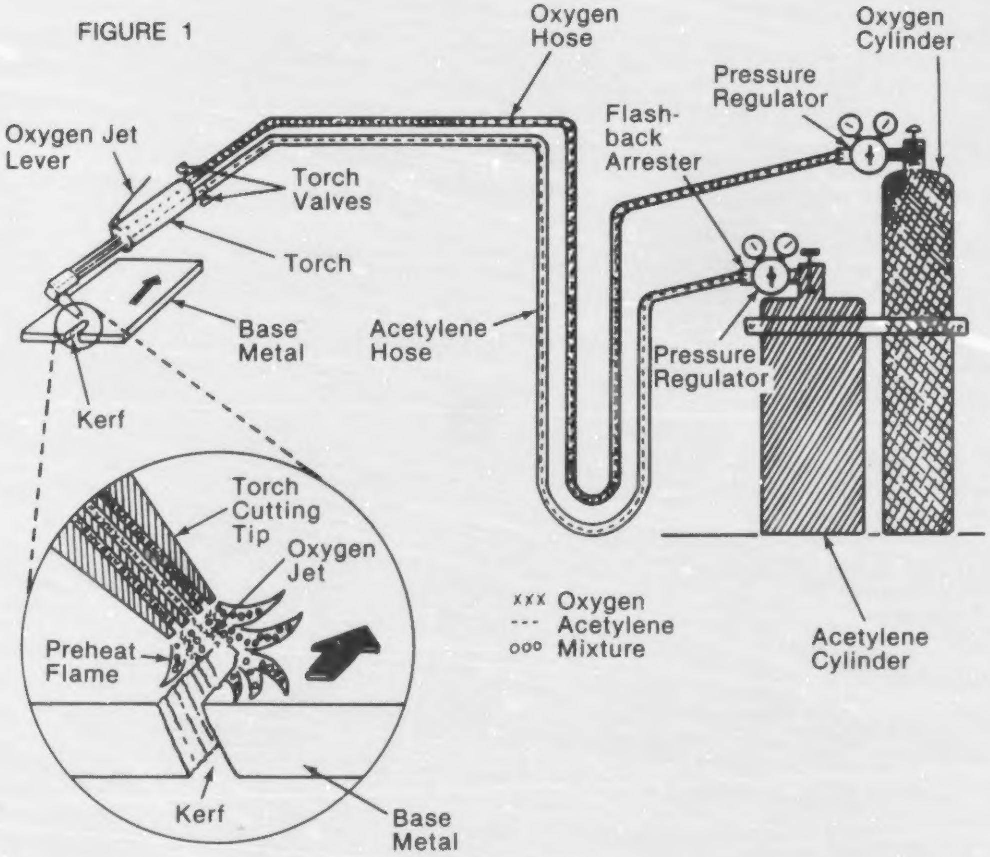
INFORMATION SHEET

III. Stages in the oxyacetylene cutting process (Figure 1)

(NOTE: A flame of oxygen mixed with acetylene [or other fuel gas] heats the base metal; then an oxygen jet cuts the heated metal. Oxyacetylene cutting is one of the most popular methods of cutting and shaping steel.)

EXAMPLE:

FIGURE 1


Oxygen Hose
Oxygen Cylinder
Pressure Regulator
Flash-back Arrester
Oxygen Jet Lever
Torch Valves
Torch
Base Metal
Acetylene Hose
Pressure Regulator
Kerf
Torch Cutting Tip
Oxygen Jet
Preheat Flame
Kerf
Base Metal
xxx Oxygen
--- Acetylene
ooo Mixture
Acetylene Cylinder

A. Pressure-regulated acetylene and pressure-regulated compressed oxygen are supplied from two cylinders

(NOTE: Each cylinder has two pressure gauges. The cylinder pressure gauge indicates pressure in the cylinder [high], and the working pressure gauge indicates the pressure of the gas being fed to the torch [low].)

B. Separate, flexible hoses carry gases to torch

(NOTE: Two needle valves control the flow of gas.)

INFORMATION SHEET

C. Operator ignites acetylene gas with spark from flint lighter

D. Operator opens oxygen torch valve, and gases are mixed inside torch

E. Mixture burns at several orifices (preheat orifices) in torch tip

F. Flame heats base metal to a dull, cherry red

G. Operator presses oxygen lever, and jet of oxygen rushes out of cutting orifice

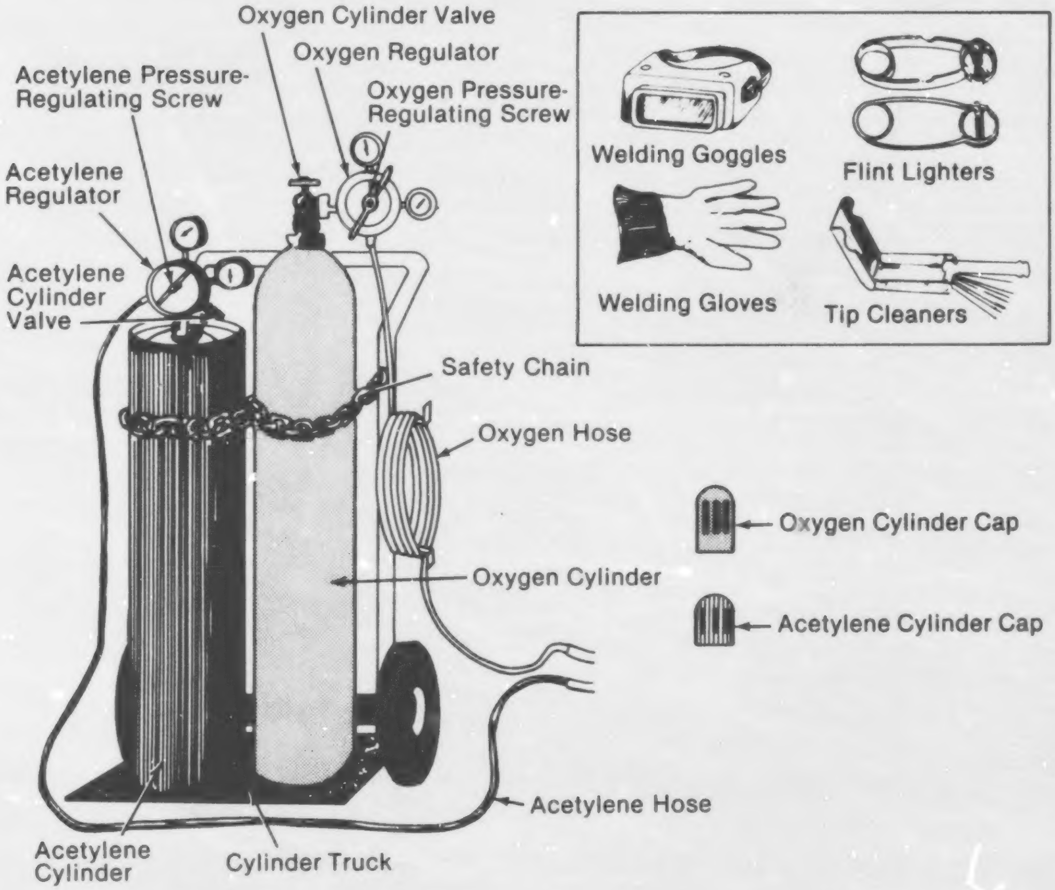
H. Oxygen jet quickly oxidizes the heated base metal and blows it away

I. Removal of material leaves a cut in the metal

IV. Parts of an oxyacetylene cutting outfit (Figure 2; Transparencies #1 and #2)

(NOTE: As an added safety feature, some outfits are equipped with antiflashback valves between regulator and torch.)

FIGURE 2

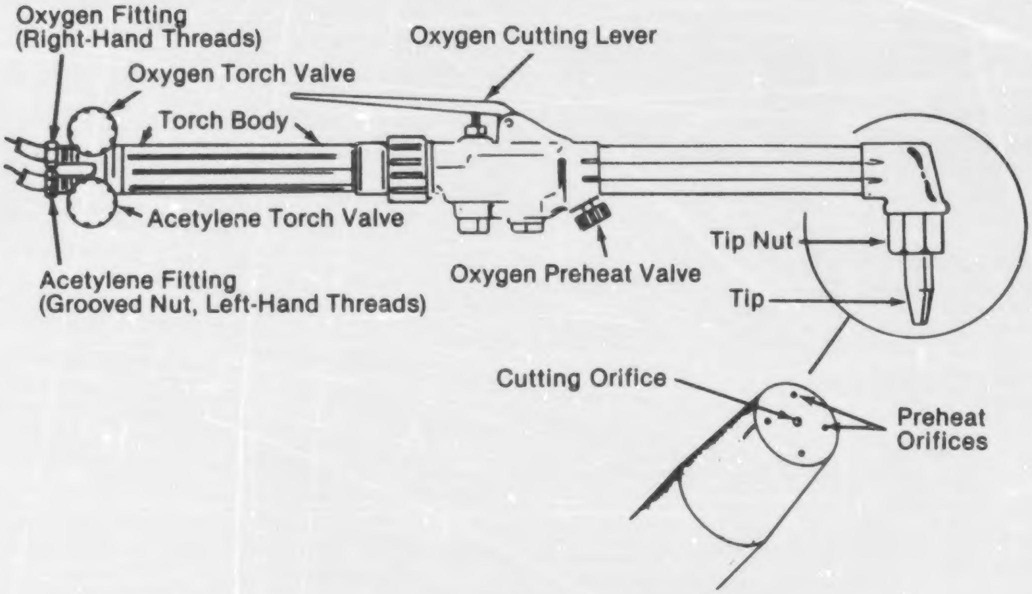

Oxygen Cylinder Valve
Oxygen Regulator
Acetylene Pressure-Regulating Screw
Oxygen Pressure-Regulating Screw
Acetylene Regulator
Acetylene Cylinder Valve
Welding Goggles
Flint Lighters
Welding Gloves
Tip Cleaners
Safety Chain
Oxygen Hose
Oxygen Cylinder Cap
Oxygen Cylinder
Acetylene Cylinder Cap
Acetylene Hose
Acetylene Cylinder
Cylinder Truck

INFORMATION SHEET

V. Parts of a torch body and cutting attachment (Figure 3)

(NOTE: The preheat orifices heat metal to a kindling point of approximately 1,600°F [755°C]. The cutting orifice removes oxidized metal.)

FIGURE 3


Oxygen Fitting (Right-Hand Threads)
Oxygen Cutting Lever
Oxygen Torch Valve
Torch Body
Acetylene Torch Valve
Tip Nut
Oxygen Preheat Valve
Acetylene Fitting (Grooved Nut, Left-Hand Threads)
Tip
Cutting Orifice
Preheat Orifices

VI. Safety rules for working with oxyacetylene equipment

(NOTE: Instructor may add other safety rules. The chief dangers of oxyacetylene cutting are burns and toxic fumes. Pay attention at all times, and notice how you feel.)

(CAUTION: If you feel dizzy or nauseated or if you have blurred vision, stop cutting and get some fresh air.)

A. Make sure that either a foam or a multipurpose dry-chemical fire extinguisher is readily available and in working condition

B. Wear welding goggles, gloves, and protective clothing

(CAUTION: Keep gloves, hands, and clothing free of oil and grease.)

C. Wear gloves to handle hot metal

INFORMATION SHEET

D. Use open torch only in a well-ventilated place

E. Avoid breathing toxic fumes

EXAMPLES: Galvanized metal fumes, some paint fumes

F. Do not leave a burning torch unattended

G. Secure cylinders in a safe place

(NOTE: Secure cylinders to protect valves and regulators and to prevent injuries.)

H. Cut or weld at least 5 feet from cylinders

I. Always use regulators; do not use oxygen or acetylene directly from cylinders

(NOTE: Be sure that regulators are used only on the cylinders that they were designed to be used on.)

J. Use flint lighters, *not matches,* for lighting torch

K. Use hoses designated for oxygen and acetylene only

L. Do not use oil on regulators, torches, fittings, or any equipment surface that may come in contact with oxygen

(CAUTION: Never oil or grease oxygen fittings. Substances will ignite with a violent explosion.)

M. Do not use compressed oxygen to clean off clothing

(CAUTION: Do not confuse compressed oxygen with compressed air. Oxygen speeds up combustion, and oxygen-soaked clothing needs only a spark to burst into flame.)

N. Do not breathe compressed oxygen directly from cylinder or hose

O. Use soapsuds and paintbrush to test connections for leaks

P. Do not use acetylene at pressures higher than 15 pounds per square inch

(CAUTION: Acetylene becomes unstable and highly explosive when pressure is over 15 psi.)

INFORMATION SHEET

Q. Do not cut or weld directly on gravel or concrete

R. Keep heat, flames, and sparks away from combustibles

S. Do not cut or weld on containers that have been used to store combustible materials unless containers have been properly cleaned and purged

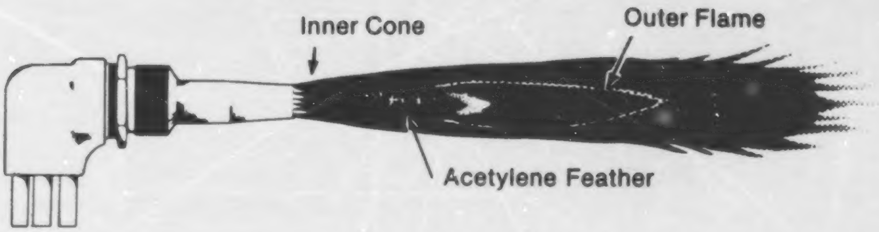
EXAMPLES: Containers that have held gases such as nitrogen, carbon dioxide, or argon

VII. Types of oxyacetylene cutting flames (Figures 4-6)

A. Carburizing flame

(NOTE: The flame illustrated has an excess of acetylene gas.)

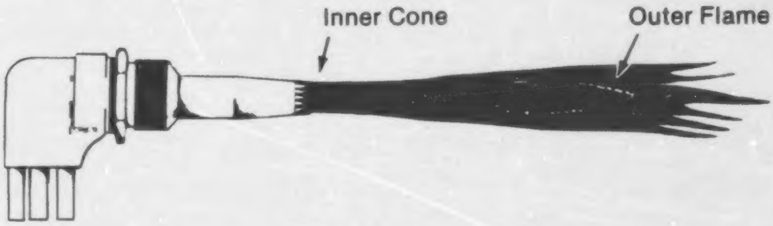
FIGURE 4



B. Neutral flame

(NOTE: The flame illustrated has the proper ratio of oxygen to acetylene.)

FIGURE 5

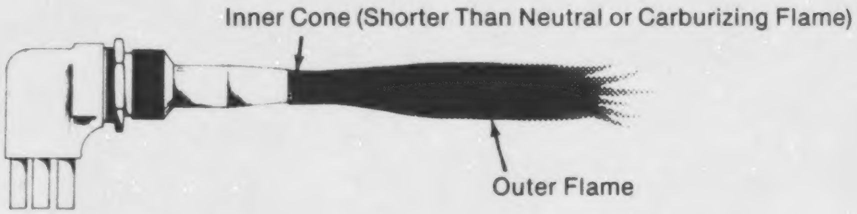


INFORMATION SHEET

C. Oxidizing flame

(NOTE: The flame illustrated has an excess of oxygen.)

FIGURE 6



VIII. Differences between flashback and backfire

A. Flashback — Flame disappears inside torch body; at the same time, a squealing noise occurs and smoke and/or sparks are emitted from the torch tip

B. Backfire — Flame burns momentarily back into tip; then a loud snap or pop is emitted from the torch and the flame either goes out or continues to burn in a normal manner

IX. Steps to follow in case of flashback

A. Close oxygen preheat valve

B. Close oxygen torch valve

C. Close acetylene torch valve

D. Release oxygen pressure-regulating screw

E. Release acetylene pressure-regulating screw

F. Examine acetylene unit

G. Reset regulator pressures

H. Light torch

(NOTE: If heavy smoke comes out of the torch tip and the torch body becomes hot, the flashback has probably traveled past the mixing chamber into the hose. In this case, shut off the oxygen and acetylene cylinder, and then notify the supervisor.)

INFORMATION SHEET

X. Causes of backfire

(NOTE: The causes listed below should be carefully checked to control backfire.)

A. Not enough acetylene or oxygen pressure for the tip size used

B. Loose cutting tip

C. Dirty tip

(NOTE: Tip may have deposits or metal particles inside orifice. These deposits may overheat and act as ignitors.)

D. Overheating of cutting tip

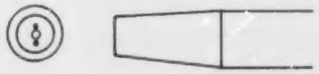
E. Bad O-ring in torch body

XI. Common cutting-torch tips and their uses (Figure 7-17)

(NOTE: Most of the following cutting tips are available in two or more sizes and should be selected on the basis of the thickness of the metal to be cut and the job to be performed.)

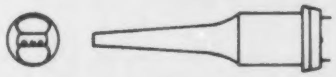
A. Straight-line or circular cutting of clean plate

FIGURE 7



B. Splitting angle iron, trimming plate, and cutting sheet metal

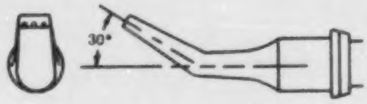
FIGURE 8



INFORMATION SHEET

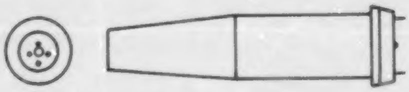
C. Hand cutting rivet heads; machine cutting 30-degree bevels

FIGURE 9



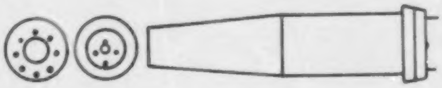
D. Straight-line or shape cutting of clean plate

FIGURE 10



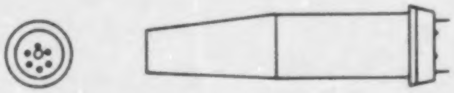
E. Cutting rusty or painted surfaces

FIGURE 11



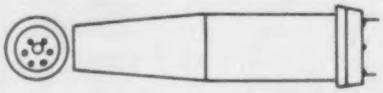
F. Cast-iron cutting and preparing welding Vs

FIGURE 12



G. General cutting; cutting cast iron and stainless steel

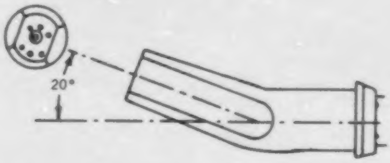
FIGURE 13



INFORMATION SHEET

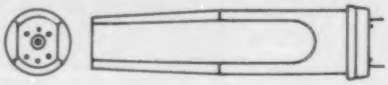
H. Grooving, flame machining, gouging, and removing imperfect welds

FIGURE 14



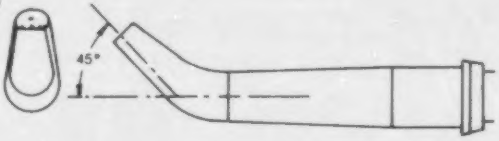
I. Grooving, gouging, or removing imperfect welds

FIGURE 15



J. Machine cutting 45-degree bevels or hand cutting rivet heads

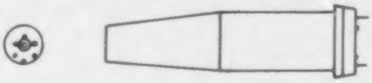
FIGURE 16



K. Removing rivet heads (washing)

(NOTE: Flared cutting orifices provide large oxygen stream of low velocity.)

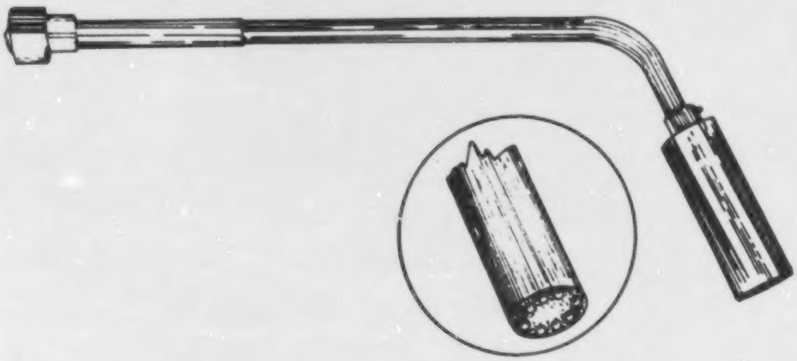
FIGURE 17



INFORMATION SHEET

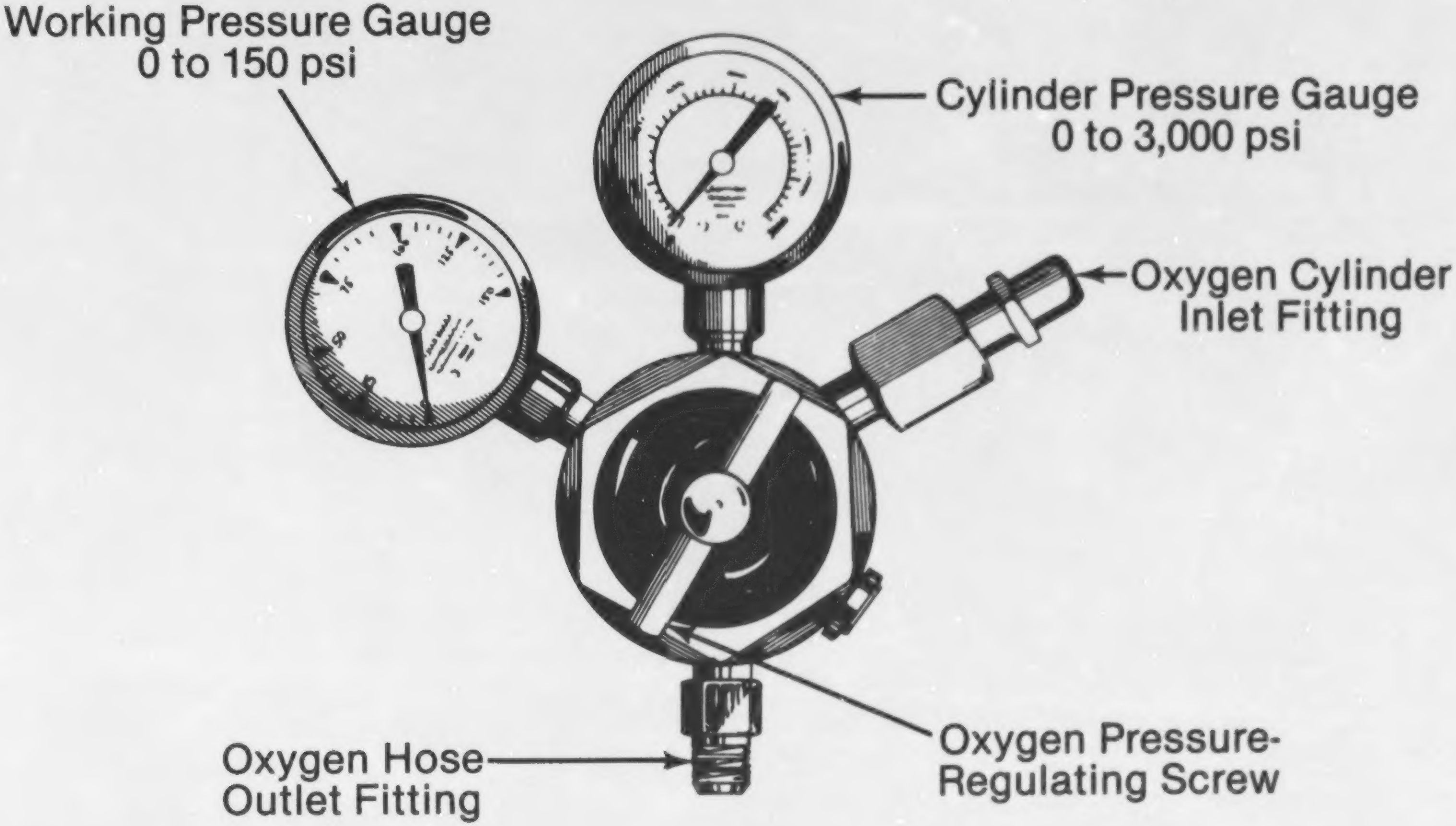
XII. Multiflame heating nozzle (rosebud) and tip (Figure 18)

FIGURE 18

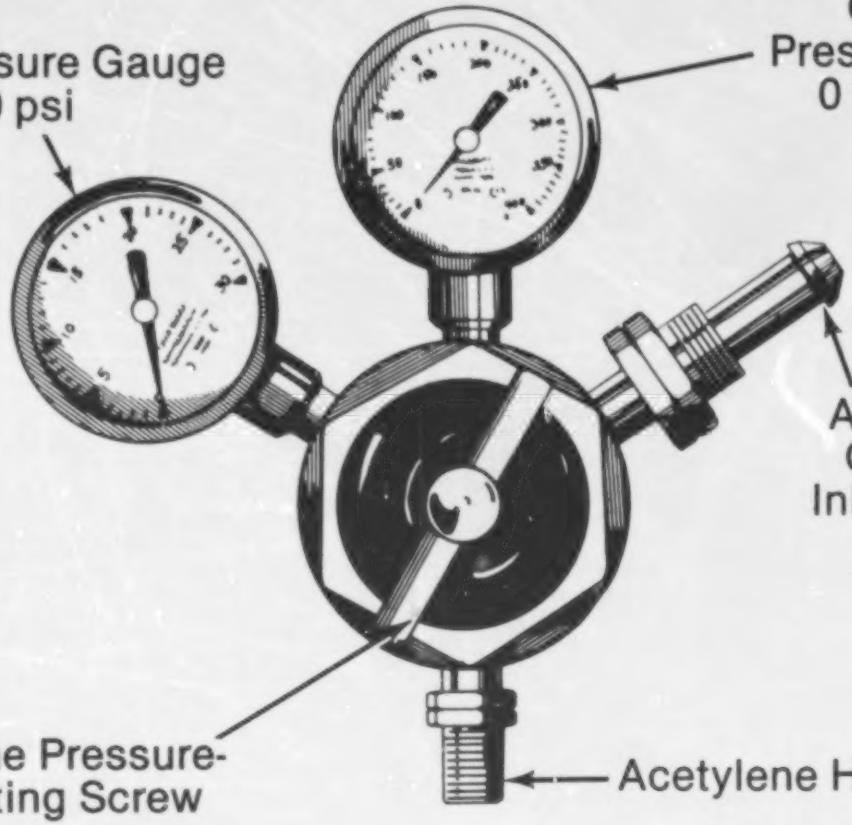


XIII. Uses of a multiflame heating nozzle (rosebud) — Used to heat parts and/or metals, such as bearings, before fitting them to the journal; also used to preheat metal before welding

Oxygen Regulator Gauges


Working Pressure Gauge
0 to 150 psi
Cylinder Pressure Gauge
0 to 3,000 psi
Oxygen Cylinder
Inlet Fitting
Oxygen Hose
Outlet Fitting
Oxygen Pressure-
Regulating Screw

Acetylene Regulator Gauges


Working Pressure Gauge
0 to 30 psi
Cylinder
Pressure Gauge
0 to 400 psi
Acetylene
Cylinder
Inlet Fitting
Acetylene Pressure-
Regulating Screw
Acetylene Hose Outlet Fitting

OXYACETYLENE CUTTING
UNIT II

JOB SHEET #1 — SET UP EQUIPMENT FOR OXYACETYLENE CUTTING

I. Equipment and materials

A. Oxygen cylinder

B. Acetylene cylinder

C. Oxygen regulator

D. Acetylene regulator

E. Hoses

F. Wrench

G. Cylinder truck

H. Foam or multipurpose dry-chemical fire extinguisher

I. Soapsuds

(NOTE: Ivory soap is recommended for making soapsuds.)

J. Clean paintbrush

K. Torch body with tips

L. Welding goggles

M. Coveralls or protective clothing free from oil and grease

II. Procedure

A. Fasten cylinders in a vertical position on cylinder truck

(CAUTION: To prevent damage to valves, never use acetylene from a cylinder that is not in a vertical position. Valve damage might cause cylinder to explode.)

B. Remove caps from cylinders

C. Crack valves of each cylinder to remove foreign material; close valves

JOB SHEET #1

D. Connect oxygen regulator to oxygen cylinder

(CAUTION: Do not use oil or any thread compound on any connections in the oxyacetylene system.)

1. Turn oxygen pressure-regulating screw counterclockwise until tension on spring is released
2. Slowly turn cylinder valve wide open

E. Connect acetylene regulator to acetylene cylinder

1. Turn acetylene pressure-regulating screw counterclockwise until tension on spring is released
2. Open cylinder valve one-half to three-quarters of a turn

   (NOTE: Never open cylinder valve more than one and one-half turns. Leave wrench with cylinder.)

F. Connect acetylene hose to acetylene regulator; purge hose

G. Connect oxygen hose to oxygen regulator; purge hose

H. Connect torch body to oxygen and acetylene hoses

I. Close both valves on torch body

J. Attach cutting attachment to torch body

(NOTE: The tip size is determined by the thickness of metal to be cut and the manufacturer's instructions.)

K. Close oxygen preheat valve on cutting attachment

L. Turn oxygen pressure-regulating screw clockwise until working pressure is reached

M. Turn acetylene pressure-regulating screw clockwise until correct working pressure is reached

(CAUTION: At pressure higher than 15 psi, acetylene becomes unstable and highly explosive.)

N. Use soapsuds to test all connections for leaks

(NOTE: Apply soapsuds with a clean paintbrush.)

O. Clean work area; clean and put away all tools and equipment

OXYACETYLENE CUTTING
UNIT II

JOB SHEET #2 — TURN ON, LIGHT, ADJUST TO A NEUTRAL FLAME, AND TURN OFF OXYACETYLENE CUTTING EQUIPMENT

I. Equipment and materials

A. Oxyacetylene cutting outfit with tip assembly

B. Wrench

C. Welding gloves

D. Welding goggles

E. Coveralls or protective clothing free from oil and grease

F. Flint lighter

G. Foam or multipurpose dry-chemical fire extinguisher

H. Tip cleaners

II. Procedure

A. Check all cylinder, regulator, and torch valves to make sure that they are closed

B. Open acetylene cylinder valve one-half to three-quarters of a turn

(CAUTION: Never open cylinder valve more than one and one-half turns.)

C. Open acetylene valve on torch one turn

D. Turn acetylene pressure-regulating screw clockwise until desired pressure is reached

(NOTE: Oxygen and acetylene pressures and size of tip depend upon the thickness of metal to be cut. Use pressures and tip size recommended by manufacturer.)

(CAUTION: Acetylene becomes unstable and highly explosive at pressures higher than 15 psi.)

E. Close acetylene valve on torch

F. Open oxygen cylinder valve all the way

G. Open oxygen torch valve all the way

JOB SHEET #2

H. Open oxygen preheat valve on cutting attachment one turn

I. Turn oxygen pressure-regulating screw clockwise until desired pressure is reached

J. Close oxygen preheat valve on cutting attachment

K. Open acetylene valve on torch one-quarter turn

L. Clean tip

(NOTE: Clean tip before lighting torch and as often as needed during cutting operation.)

M. Light torch with flint lighter and adjust until smoke on flame clears

N. Open oxygen preheat valve slowly and adjust to a neutral flame

O. Depress oxygen cutting lever, and check to see that a neutral flame is present

(NOTE: If necessary, adjust the oxygen preheat valve with the oxygen cutting lever depressed until a neutral flame is secured. Pressure rises slightly when valve is closed.)

P. Close acetylene valve on torch

Q. Close acetylene cylinder valve

R. Close oxygen preheat valve

S. Close oxygen cylinder valve

T. Open acetylene valve on torch

(NOTE: When gauges reach zero, close torch valve and release acetylene pressure-regulating screw by turning counterclockwise.)

U. Open oxygen preheat valve on torch

(NOTE: When gauges reach zero, close oxygen preheat valve and turn oxygene pressure-regulating screw counterclockwise.)

V. Close oxygen valve on torch

W. Place torch and hose on hanger or brackets provided

(NOTE: If regulators are removed from cylinders, replace the caps.)

X. Clean work area; clean and put away all tools and equipment

OXYACETYLENE CUTTING
UNIT II

JOB SHEET #3 — CUT MILD STEEL AT A 90-DEGREE ANGLE, STOP, AND RESTART THE CUT

I. Equipment and materials

- A. Oxyacetylene cutting outfit with tip assembly
- B. Mild steel plate, approximately 1/4" × 4" × 8"
- C. Soapstone with a sharp point or edge
- D. Straightedge
- E. Welding gloves
- F. Welding goggles
- G. Pliers
- H. Coveralls or protective clothing free from oil and grease
- I. Flint lighter
- J. Welding or cutting table
- K. Slag box
- L. Can of water
- M. Cutting tip
- N. Foam or multipurpose dry-chemical fire extinguisher
- O. Tip cleaners

II. Procedure

- A. Make a 90-degree cut
    1. Mark four parallel lines 2 inches apart on plate to be cut
    2. Adjust oxygen regulator
    3. Adjust acetylene regulator
    4. Place plate to be cut over slag box

JOB SHEET #3

5. Clean tip

   (NOTE: Clean tip before lighting torch and as often as needed during cutting operation.)

6. Light torch with flint lighter

7. Adjust to neutral flame

8. Place hoses behind you

9. Assume comfortable position

10. Maneuver torch as required

    (NOTE: Sometimes you must use both hands to hold torch steady for a straight cut.)

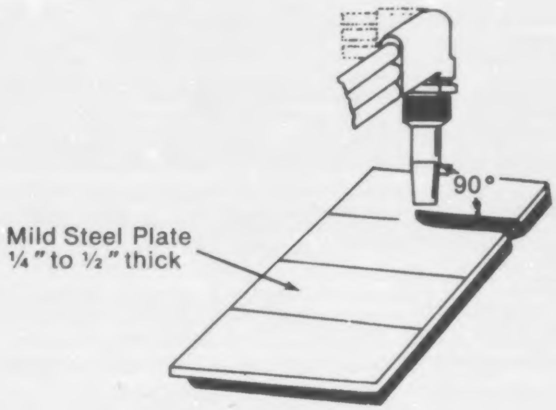
11. Hold preheat flame with tip of inner cone 1/16 to 1/8 inch above top of plate at right edge until red spot appears

    (CAUTION: Burning metal flames and sometimes sparks, creating the danger of burns.)

12. Depress oxygen cutting lever and move from right to left across the plate (Figure 19)

    (NOTE: Left-handed operators move from left to right.)

FIGURE 19



JOB SHEET #3

13. Hold tip at right angle to work, while cutting with inner cone approximately 1/6 inch above work

14. Make 90-degree cuts until you have developed the proper procedure

15. Cool metal by placing in can of water with the aid of pliers

B. Restart a cut

1. Release oxygen cutting lever

2. Preheat only the edge where cutting action was stopped

3. Depress oxygen cutting lever slowly and continue cut

C. Clean work area; clean and put away all tools and equipment

OXYACETYLENE CUTTING
UNIT II

JOB SHEET #4 — CUT ROUND STOCK

I. Equipment and materials

A. Oxyacetylene cutting outfit with tip assembly

B. Pieces of reinforcing bar, 1/2-inch, 5/8-inch, 3/4-inch, or 1-inch

C. Soapstone with sharp point or edge

D. Tape

E. Welding gloves

F. Welding goggles

G. Pliers

H. Coveralls or protective clothing free from oil and grease

I. Flint lighter

J. Welding or cutting table

K. Slag box

L. Can of water

M. Cutting tip

N. Foam or multipurpose dry-chemical fire extinguisher

O. Tip cleaners

II. Procedure

A. Mark reinforcing bar at desired length

B. Adjust oxygen and acetylene regulators

C. Place area to be cut over slag box

D. Clean tip

(NOTE: Clean tip before lighting torch and as often as needed during welding operation.)

JOB SHEET #4

E. Light torch with flint lighter

F. Adjust to neutral flame

G. Place hoses behind you

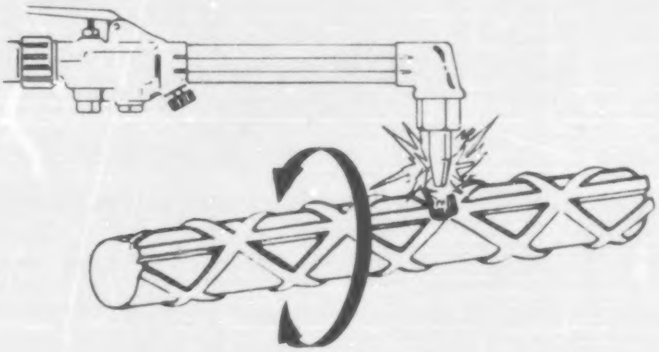
H. Assume comfortable position

I. Maneuver torch as required

J. Hold preheat flame with tip of inner cone $^1/_{16}$ to $^1/_8$ inch above edge of reinforcing bar until it becomes red

K. Depress cutting lever, and rotate torch in direction of travel until rod is cut (Figure 20)

FIGURE 20



L. Hold tip at right angle to work, while cutting with inner cone approximately $^1/_{16}$ inch above work

M. Cool metal by placing in can of water with the aid of pliers

N. Repeat procedure for each bar or rod

O. Clean work area; clean and put away all tools and equipment

OXYACETYLENE CUTTING
UNIT II

TEST

NAME ______________________ SCORE ______________

1. Match terms associated with oxyacetylene cutting to their correct definitions. Write the correct numbers in the blanks.

______a. Colorless, gaseous hydrocarbon used in cutting and welding

______b. Element that is normally a colorless, odorless, and tasteless gas; used in combination with other substances in cutting and welding

______c. Flame cutting of metal in which the preheating of the metal is accomplished with a flame produced by an oxyacetylene torch

______d. To remove any foreign material from a system or component by flushing with the gas used in that system

______e. Pounds per square inch

______f. Capable of burning

______g. Poisonous

______h. That part of a shaft, axle, or spindle that turns in a bearing

______i. Striker used to ignite torch

______j. Metal container with a layer of water or sand to catch hot material

______k. Metal that melts away during the oxyacetylene cutting process

1. Toxic
2. Purge
3. Oxygen
4. Combustible
5. Oxyacetylene cutting
6. psi
7. Acetylene
8. Flint lighter
9. Journal
10. Slag box
11. Slag

2. State color codes for oxygen and acetylene.

a. Oxygen — ______________________

b. Acetylene — ______________________

TEST

3. Arrange in order stages in the oxyacetylene cutting process. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Mixture burns at several orifices (preheat orifices) in torch tip

_____b. Oxygen jet quickly oxidizes the heated base metal and blows it away

_____c. Separate, flexible hoses carry gases to torch

_____d. Flame heats base metal to a dull, cherry red

_____e. Pressure-regulated acetylene and pressure-regulated compressed oxygen are supplied from two cylinders

_____f. Removal of material leaves a cut in the metal

_____g. Operator ignites acetylene gas with spark from flint lighter

_____h. Operator presses oxygen lever, and jet of oxygen rushes out of cutting orifice

_____i. Operator opens oxygen torch valve, and gases are mixed inside torch

TEST

4. Identify the parts of an oxyacetylene cutting outfit. Write the correct numbers in the blanks.

______a. Oxygen hose

______b. Oxygen cylinder valve

______c. Acetylene cylinder

______d. Acetylene cylinder cap

______e. Welding gloves

______f. Oxygen cylinder

______g. Acetylene hose

______h. Acetylene regulator

______i. Acetylene pressure-regulating screw

______j. Flint lighters

______k. Oxygen cylinder cap

______l. Safety chain

______m. Welding goggles

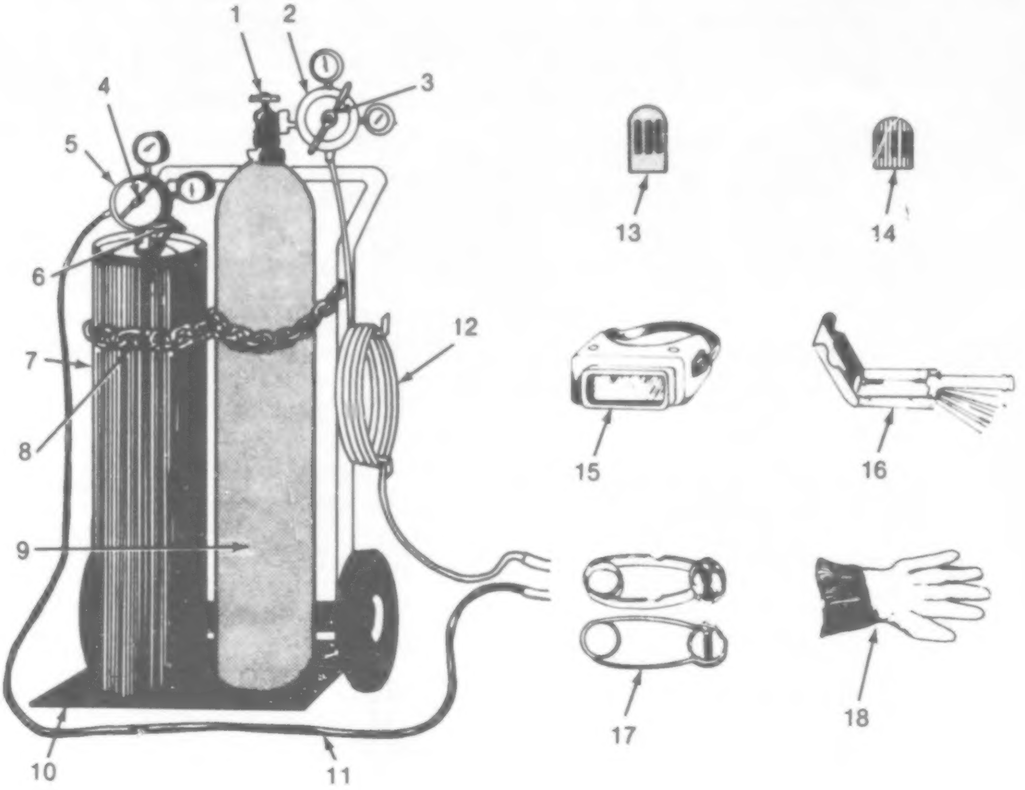
______n. Acetylene cylinder valve

______o. Oxygen pressure-regulating screw

______p. Tip cleaners

______q. Oxygen regulator

______r. Cylinder truck



TEST

5. Identify the parts of a torch body and cutting attachment. Write the correct numbers in the blanks.

_____a. Acetylene fitting (grooved nut, left-hand threads)

_____b. Cutting orifice

_____c. Oxygen fitting (right-hand threads)

_____d. Tip nut

_____e. Oxygen preheat valve

_____f. Preheat orifices

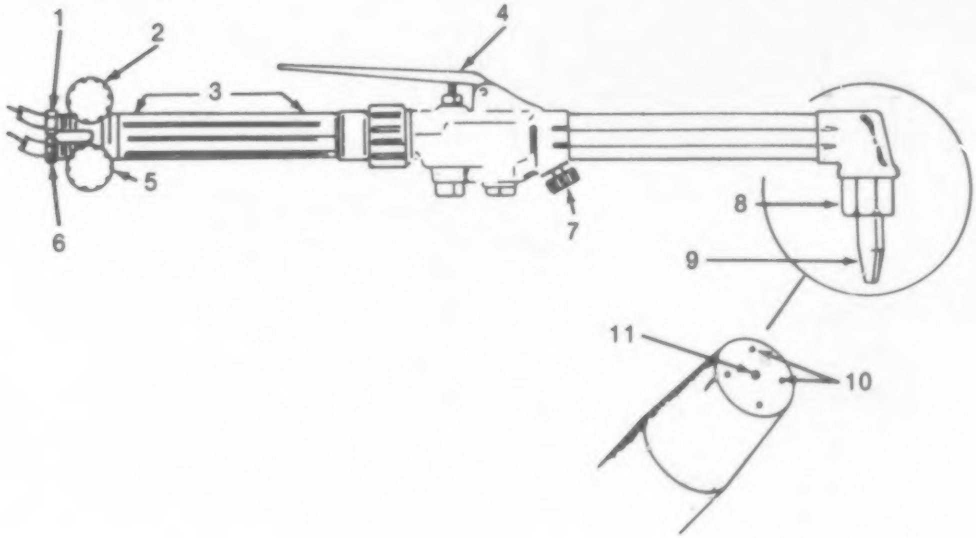
_____g. Oxygen torch valve

_____h. Tip

_____i. Oxygen cutting lever

_____j. Torch body

_____k. Acetylene torch valve



6. State twelve safety rules for working with oxyacetylene equipment.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

TEST

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

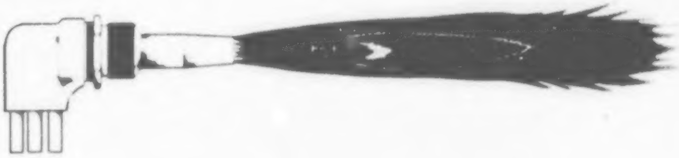
j. ______________________________

k. ______________________________

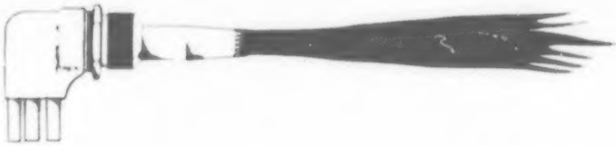
l. ______________________________

7. Identify the following types of oxyacetylene cutting flames. Write the correct names in the blanks.

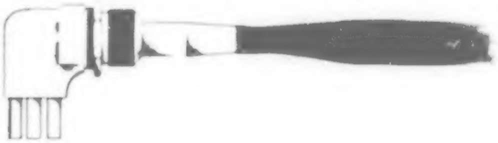
Neutral flame **Oxidizing flame** **Carburizing flame**



a. ______________________________



b. ______________________________



c. ______________________________

TEST

8. Distinguish between flashback and backfire. Write an "F" in the blank before flashback and a "B" in the blank before backfire.

______a. Flame burns momentarily back into tip; then a loud snap or pop is emitted from the torch and the flame either goes out or continues to burn in a normal manner

______b. Flame disappears inside torch body; at the same time, a squealing noise occurs and smoke and/or sparks are emitted from the torch tip

9. Arrange in order steps to follow in case of flashback. Write a "1" before the first step, a "2" before the second step, and so on.

______a. Light torch

______b. Release oxygen pressure-regulating screw

______c. Reset regulator pressures

______d. Close oxygen torch valve

______e. Close oxygen preheat valve

______f. Release acetylene pressure-regulating screw

______g. Close acetylene torch valve

______h. Examine acetylene unit

10. Select from the following list causes of backfire. Write an "X" in the blank before each correct answer.

______a. Too much oxygen

______b. Not enough acetylene or oxygen pressure for the tip size used

______c. Too much acetylene

______d. Loose cutting tip

______e. Overheating of cutting tip

______f. Bad O-ring in torch body

______g. Dirty tip

TEST

11. Match common cutting-torch tips to their correct uses. Write the correct numbers in the blanks.

______a. Machine cutting 45-degree bevels or hand cutting rivet heads

______b. Cast-iron cutting and preparing welding Vs

______c. Splitting angle iron, trimming plate, and cutting sheet metal

______d. General cutting; cutting cast iron and stainless steel

______e. Grooving, gouging, or removing imperfect welds

______f. Hand cutting rivet heads; machine cutting 30-degree bevels

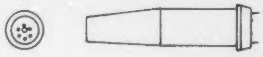
______g. Straight-line or circular cutting of clean plate

______h. Cutting rusty or painted surfaces

______i. Grooving, flame machining, gouging, and removing imperfect welds

______j. Removing rivet heads (washing)

______k. Straight-line or shape cutting of clean plate

1.


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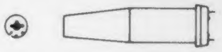

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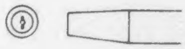

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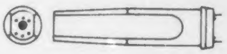

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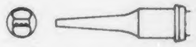

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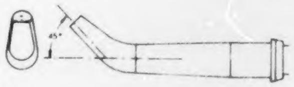

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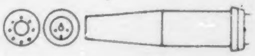

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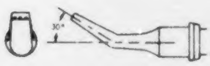

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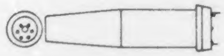

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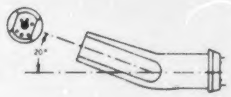

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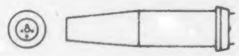
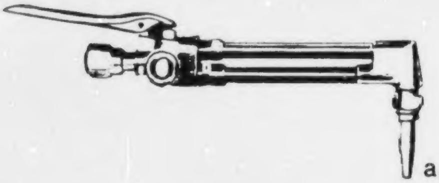
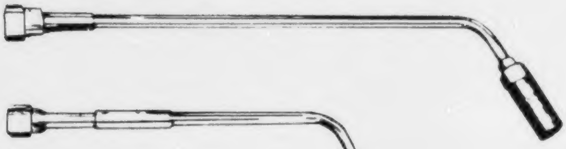


TEST

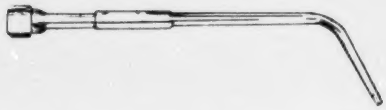
12. Identify a multiflame heating nozzle (rosebud) and tip from the illustrations below. Write an "X" in the blank beside the correct illustration.



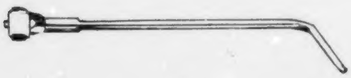
a. ____________________



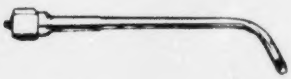
b. ____________________



c. ____________________



d. ____________________



e. ____________________

13. Describe uses of a multiflame heating nozzle (rosebud) — ____________________

____

____

____

(NOTE: Test question 14 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

14. Demonstrate the ability to

    a. Set up equipment for oxyacetylene cutting.

    b. Turn on, light, adjust to a neutral flame, and turn off oxyacetylene cutting equipment.

    c. Cut mild steel at a 90-degree angle, stop, and restart the cut.

    d. Cut round stock.

OXYACETYLENE CUTTING
UNIT II

ANSWERS TO TEST

1.	a.	7	d.	2	g.	1	j.	10
	b.	3	e.	6	h.	9	k.	11
	c.	5	f.	4	i.	8		

2. a. Green

b. Red

3.	a.	5	d.	6	g.	3
	b.	8	e.	1	h.	7
	c.	2	f.	9	i.	4

4.	a.	12	f.	9	k.	13	p.	16
	b.	1	g.	11	l.	8	q.	2
	c.	7	h.	5	m.	15	r.	10
	d.	14	i.	4	n.	6		
	e.	18	j.	17	o.	3		

5.	a.	6	e.	7	i.	4
	b.	11	f.	10	j.	3
	c.	1	g.	2	k.	5
	d.	8	h.	9		

6. Answer should include any twelve of the following

a. Make sure that either a foam or a multipurpose dry-chemical fire extinguisher is readily available and in working condition

b. Wear welding goggles, gloves, and protective clothing

ANSWERS TO TEST

c. Wear gloves to handle hot metal

d. Use open torch only in a well-ventilated place

e. Avoid breathing toxic fumes

f. Do not leave a burning torch unattended

g. Secure cylinders in a safe place

h. Cut or weld at least 5 feet from cylinders

i. Always use regulators; do not use oxygen or acetylene directly from cylinders

j. Use flint lighters, *not matches,* for lighting torch

k. Use hoses designated for oxygen and acetylene only

l. Do not use oil on regulators, torches, fittings, or any equipment surface that may come in contact with oxygen

m. Do not use compressed oxygen to clean off clothing

n. Do not breathe compressed oxygen directly from cylinder or hose

o. Use soapsuds and paintbrush to test connections for leaks

p. Do not use acetylene at pressures higher than 15 pounds per square inch

q. Do not cut or weld directly on gravel or concrete

r. Keep heat, flames, and sparks away from combustibles

s. Do not cut or weld on containers that have been used to store combustible materials unless containers have been properly cleaned and purged

7. a. Carburizing flame

   b. Neutral flame

   c. Oxidizing flame

8. a. B

   b. F

ANSWERS TO TEST

9.

a.	8	e.	1
b.	4	f.	5
c.	7	g.	3
d.	2	h.	6

10. b, d, e, f, g

11.

a.	6	e.	4	i.	10
b.	1	f.	8	j.	2
c.	5	g.	3	k.	11
d.	9	h.	7		

12. b

13. Description should include the following — Used to heat parts and/or metals, such as bearings, before fitting them to the journal; also used to preheat metal before welding

14. Performance skills evaluated to the satisfaction of the instructor